JENNIFER M. GRANHOLM
GOVERNOR

STATE OF MICHIGAN
DEPARTMENT OF TRANSPORTATION
LANSING

KIRK T. STEUDLE
DIRECTOR

March 6, 2006

The Honorable Shirley Johnson, Chair
Senate Appropriations Committee
Michigan State Senate
P.O. Box 30036
Lansing, Michigan 48909

The Honorable Scott Hummel, Chair
House Appropriations Committee
Michigan House of Representatives
P.O. Box 30014
Lansing, Michigan 48909

Dear Senator Johnson and Representative Hummel:

In accordance with section 363 of 2004 PA 361, enclosed is the Log Truck Study II completed by Michigan Technological University.

If you have any questions or comments regarding this report, feel free to contact either me or Susan G. Brook, Administrator, Office of Special Projects and Initiatives, at (517) 335-1934.

Sincerely,

Kirk T. Steudle
Director

Enclosure

cc: Members of Senate and House Appropriations Committees
M. Lannoye, State Budget Director
C. Thiel, Senate Fiscal Agency
W. Hamilton, House Fiscal Agency

EXEC:OSP:Brook:dh
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Federal Project Number

Michigan Log Truck Study II

FINAL Report

November 2005

Submitted by

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Keweenaw Research Center

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September 2005

LOG TRUCK STUDY II

FINAL REPORT

Submitted by

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EXECUTIVE SUMMARY

Michigan's timber industry has a significant impact on the State's economy. Michigan log trucks move about 250,000 loads of logs yearly. This translates into 23 million miles of loaded vehicle travel. Michigan's log truck combinations are currently some of the largest vehicles on the roads today.

This study continues the Michigan Log Truck Study that was done in 2003. The primary focus areas of this study are: Update the Literature Review done in 2003, Inventory the Characteristics/Configurations of Log Trucks and Log Loads, Review Log Truck Crashes and Spills, and Recommend Practices and Innovations for Existing Documented Hazards.

The Michigan log truck combination, consisting of a truck and trailer, fall into the Long Combination Vehicle (LCV) category. Michigan combination log trucks are currently limited by federal law to a maximum of 70 feet. The federal restriction of overall vehicle length has slowed the Michigan conversion to crib style trucks and trailers for log hauling. Recent requests to increase the length of Michigan log truck/trailer combinations from 70 to 75 feet have been denied at the federal level.

This study monitored sites in the Upper Peninsula and the northern half of the Lower Peninsula to determine the size and characteristics of trucks hauling logs in Michigan. Log hauling vehicles in Michigan come in a wide variety of configurations and sizes - there is no such thing as a "standard" log truck and trailer.

With over 1,000 sightings, 885 log trucks were recorded on public roads. Of this total, 636 were clearly identified for configuration and characteristics such as truck axles, trailer axles, self-loader, log load orientation, and securement method. The inventory identified 373 unique vehicles. It is estimated that in 2005 there are at least 800 log trucks active in Michigan. The majority (over 80%) of the log hauling vehicles in the U.P. are the 11 axle truck/pup trailer combinations with a self loader.

The frequency of log trucks sighted ranged from one truck every 4+ minutes at Sagola, to one truck every 24+ minutes at West Branch. Of the 338 trucks that were sighted loaded, 86% were crosswise loaded. When the load securement method could be identified, the majority used chains for tie-downs. Air binders were found to be well accepted (upwards of 90%) in the U.P., but not as common in the Lower Peninsula.

Auto tensioners evolved because of a need for a securement binder that would accommodate the settling of a load of logs. This study found that air binders were used on the majority (90%) of the trailers operating in the U.P. Currently there are no standards or specifications for air binders. Task 5 of this report includes recommendations for good design practices.

Michigan truckers have not readily adopted the crib style vehicle. A crib style vehicle carries logs lengthwise with lateral securement (bunks) and front and rear gates that prevent longitudinal shifting of the logs. Although crib style trailers offer an improvement in log hauling safety, they are not being adopted for two reasons – load capacity and load securement. The biggest issue with crib style rigs in Michigan is load capacity. For a self-loading truck and trailer crib design to carry the same weight and volume of logs as is legal when crosswise loaded, a length exceeding the current 70 foot federal limit is required. Requests by Michigan for an increase in overall length at the federal level have been denied. Secondly, Michigan's load securement law requiring two tie-downs per bundle is more restrictive than the FMCSA regulations. The time required to attach and detach 12 tie-downs, compared to four tie-downs for a crosswise loaded vehicle, is a significant deterrent to the acceptance of crib hauling.

Log truck crashes in the U.P. during 2001-2003 were compared with “all vehicle” crashes and the “truck/bus” crashes for the same period. Within individual counties, the distribution patterns of log truck crashes follow the patterns of the all-vehicle crashes and the truck/bus crashes.

Even when using extremely conservative estimates for the number of log trucks and vehicle miles traveled for log trucks, the total crash and injury crash rates (crashes and injuries per 100 Million VMT) for log trucks are significantly lower when compared to crash rates for all U.P. traffic, all State of Michigan traffic, and heavy truck traffic nationally. This indicates that log trucks generally pose less of a crash and injury risk per vehicle mile traveled than the aggregate traffic in the state, the U.P., and for heavy trucks nationally.

Limited success was achieved in attempts to identify and contact log truck drivers who were involved in log spill incidents. Because of the small sampling size, there is not enough data to allow conclusions to be drawn. However, the information gained from the interviews may provide some general insight into the nature of the spill problem. If further study of log spill incidents is a concern to policy makers, a better method for tracking log truck spill incidents would be required.

Conclusions

- Crosswise loaded pup trailers will continue to present a spill risk, but the hundreds of thousands of loads that are hauled annually without incident indicate that this is an acceptable transportation method.
- Automatic tensioners are helpful for securing a load of logs, but they are not the sole solution for preventing log spills.
- Crib style vehicles, where lateral securement is built into the vehicle, are not being readily adopted in Michigan due to the reduced capacity and tie-down requirements.
- The distribution and patterns of log truck crashes are similar to that of all traffic in the U.P. and truck/bus traffic in the U.P.
- The crash rate for log trucks, crashes per 100 million miles traveled, is less than that for all traffic in the U.P., all traffic in Michigan, and all heavy truck/bus traffic in the U.S.
- Fatality and incapacitating injury rates are significantly lower than the rates for all U.P. traffic and equal to or less than the rate for all Michigan traffic.
- The insurance industry has been and will continue to be instrumental in getting high risk drivers and vehicles off the road.

Recommendations

- The Michigan timber industry should continue to educate log truck drivers on proper loading and securement techniques.
- The Michigan State Police Motor Carrier Division should continue to offer Log Truck Inspections on an annual basis. Mills are willing to support this effort.
- Michigan should consider adoption of the latest Federal Motor Carrier Safety Administration’s interpretation of tie-down requirements for crib style vehicles.
- Crib style vehicles should be encouraged.
- Automatic tensioners should be encouraged, especially on trailers.

- Begin classifying log truck load loss as part of the crash reporting.
- Develop a better log truck crash reporting process.
- A feasibility study could be conducted to determine if smaller 7 or 8 axle truck trailer combinations are an economically viable option.

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TASK 1 – LITERATURE REVIEW

Size, Weight and Securement Issues of Michigan Log Trucks 2005 Update

This literature review identifies developments affecting the log hauling industry in Michigan since the *Michigan Log Truck Study – Final Report* that was published in February 2003.

Truck Size and Weight Issues

Long Combination Vehicles (LCVs) are normally considered a tractor with either two or three trailers. The Michigan log truck combination, consisting of a truck and trailer, also falls into this category. Michigan log truck combinations are currently limited to a maximum of 70 feet for the truck and trailer. Changes in maximum overall vehicle length require a federal "Act of Congress" and are not left to state jurisdiction.

The Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991 froze the allowable length, weight and routes of LCVs. Recent requests to increase the length of Michigan log truck/trailer combinations from 70 to 75 feet have been denied at the federal level. Michigan's logging interests had hoped that the length issue would be addressed in the reauthorization of TEA-21.

Prior to considering the reauthorization of TEA-21, Congress requested a study on truck size and weight issues. The Transportation Research Board (TRB) issued Special Report (SR-267) in May 2004. The report's recommendations included significant reforms in how trucking regulations should be developed – logical engineering/scientific basis versus political agendas. None of the SR-267 recommendations were included in the reauthorization of TEA21-SAFETEA-LU.

While TEA-21 reauthorization was being considered, additional legislation was introduced to further restrict longer vehicles. The Safe Highways and Infrastructure Protection Act, SHIPA – Senate Resolution S-95, (was S-1445 during the 108th Congress) intended to extend the current restriction of LCVs for the 44,000 mile Interstate Highway System to the 156,000 mile National Highway System (NHS). In addition, the length restriction would apply to all new NHS routes and existing routes where capacity is increased. On January 24, 2005, the resolution was referred to the Senate Environment and Public Works Committee where it awaits action.

During TEA-21 reauthorization, the Association of American Railroads (AAR) and the American Trucking Association (ATA), two major stakeholders in the transportation act because of freight movement, signed an agreement to not contest trucking size and weight issues. The AAR has fought for a decrease in truck size and weight on the basis that the trucking industry is not paying its fair share for road use. The ATA, which represents such major trucking interests as United Parcel Services, FedEx Freight, Roadway Express and Yellow Transportation, agreed to not lobby for increased capacity changes, even though some of their members would benefit from increased capacity. The ATA/AAR agreement was based on the fact that there were other more critical issues for the trucking industry that needed to be addressed before the truck size and weight issue.

It is unlikely that the federal restriction on overall vehicle length of 70 feet, and hence the 75 foot crib-style vehicle, will be considered until the reauthorization of SAFETEA-LU.

Size and Weight Issues in Michigan

The move to increase the overall length of Michigan logging trucks to 75 feet was initially proposed in November 2002 as House Bill 6486 (2002), but this died in the Senate in December 2002. The proposal re-emerged in House Bill 4154 (2003) which was introduced in February 2003 and was eventually passed and approved by the Governor on July 31, 2003, as Public Act 142 of 2003, effective August 5, 2003.

The increased length allowance in this legislation was in conflict with federal length restrictions. If enacted, Michigan would be subjected to federal sanctions that could amount to 10% or up to $90 million dollars of its federal transportation funds. The final bill was modified to include a statement that the length increase would not become effective until Section 127(d) of Title 23 of the United States Code, 23USC 127, was amended to allow 75 foot long crib-style log vehicles.

In March 2004, the Michigan House of Representatives tried once again to push Congress to act on the 75 foot crib-style log trucks by adopting House Resolution 0168 (2003). The resolution's intent was to get Congress and the United States Department of Transportation to permit the use of 75 foot crib carrier log hauling equipment during the Surface Transportation Reauthorization.

In 2004, Michigan did, however, make the following size changes that did not conflict with federal restrictions:

- Maximum trailer width was increased from 96 to 102 inches for all roads under Section 257.717 of Act 511 of 2004. Previously 102 inch wide trailers were only allowed on designated highways.
- The 65 foot maximum length limit was extended to other combination vehicles (gravel trains hauling certain bulk commodities related to the construction industry) under Public Act 420 of 2004; effective January 1, 2006 (was House Bill 4358 in 2003). The general length limit is 59 feet for most combinations.

Crib-Style Log Hauling Update

During the initial *Michigan Log Truck Study* two vehicles received over-length permits so that crib-style log-hauling vehicles could be investigated. The vehicles, owned by Casperson and Bellmore, were 72 feet and 75 feet long respectively. Both permits for over-length vehicles expired on May 16, 2003. Applications were submitted for renewing the permits, but after review by MDOT and FHWA, the request was denied (see copies of documents in Appendix 1). The reason given in the denial was that the logs were a “divisible load” that could be split into smaller quantities that would not require the use of over-length vehicles. Both vehicles have been converted to crosswise hauling.

Lift Axle Clarification

Public Act 420 of 2004, Section 257.724, effective January 1,2006 (was House Bill 4358 in 2003) revised the fine structure for misloaded trucks and clarified the procedures for weighing trucks with lift axles. A misloaded vehicle is below its allowable gross combination vehicle weight (GCVW), but has one or more axles that exceed the legal axle weight maximum. The section also includes recognition of “lift axles” and exempts the axle weight laws for the time period when the axles are raised for making a turn. Prior to weighing a vehicle, an enforcement officer shall allow the lift axles to be lowered and placed under full operational pressure.

Canadian Research into Size and Weight

The Forest Engineering Research Institute of Canada (FERIC) has been studying the rollover stability of log hauling trucks since 1992. For increased stability they have recommended increasing the track width of trailers to 114 inches. FERIC is also encouraging a performance based weight program. This program bases a vehicle's weight capacity on stability performance; the better the stability performance of a vehicle the greater weight they would be allowed to carry.

Load Securement Issues

The *Development of a North American Standard for Protection Against Shifting and Falling Cargo- Final Rule* was released by the US Department of Transportation (USDOT) on September 27, 2002. In order to allow the trucking industry to become knowledgeable and adjust to the new rules, the rules did not become effective until January 1, 2004.

The Notice of Proposed Rule Making (NPRM) contains a special provision for log hauling that allows the total working load limit of all the securement devices to be $1/6^{th}$ the load instead of the 1/2 load weight required for all other commodities. Without this provision the current Michigan securement practice for crosswise loaded logs of using two tie-downs per bundle of logs would have increased to four tie-downs per bundle or required the use of much larger and heavier chains. The current two tie-downs per bundle requirement creates such a time consuming burden that few Michigan truckers will even consider crib-style lengthwise loading of pulpwood.

The issue of load securement on crib style log trucks was brought to the Federal Motor Carriers Safety Administration (FMCSA) by the Timber Producers Association of Wisconsin and Michigan. The ruling (see copy in Appendix 2) stated, "… the use of a crib-style log Securement system, without wrappers or tie-downs, would satisfy the commodity-specific requirements …" of 49 CFR 393.116. Five qualifications were included regarding the applicability of the ruling.

The FMCSA decision to allow crib vehicles without tie-downs has had a great impact in Wisconsin. Wisconsin truckers have recognized the safety of crib hauling and the time saving benefits of not having to use tie-downs. One major log trailer manufacturer is currently building 20 crib trailers for every traditional rail trailer.

Canadian Cargo Securement

Canada adopted a load securement act similar to the U.S. version. Known as *National Safety Code Standard 10 – Cargo Securement*, it was approved on September 23, 2004 by the Council of Ministers Responsible for Transportation and Highway Safety (ISBN 0-921795-71-8). In the new Canadian securement regulations, at least one binder is required for each bunk/crib of a load of lengthwise wood. The act can be found on the Canadian Council of Motor Transport Administrators (CCMTA) website at www.ccmta.ca.

Other Considerations

Federal

The Federal Motor Carrier Safety Administration (FMCSA) has held "listening sessions" across the nation to find the issues that concern the general public. A comment relating to the logging industry under consideration is that federal safety policy should focus more on drivers and less on equipment.

Hours of Service

Hours of Service (HOS) regulations continue to be unresolved at the Federal level. The new April 2003 HOS rules by the FMCSA will remain in effect until September 30, 2005. FMCSA issued a Notice of Proposed New Rulemaking on January 24, 2005, and hopes to get new regulation in place during 2005.

HOS generally does not affect Michigan log haulers as most claim to fall under the exemption of working within a 100-mile radius and less than 12 hours per day. But in a related matter, FMCSA is currently looking into Electronic On-Board Recorders (EOBR) as a method for maintaining an accurate electronic logbook of driver’s hours of service (ANPRM Vol.69, No. 169 Federal Register 53386, September 1, 2004). If the EOBR continue to grow in popularity, the FMSCA could make them mandatory on all new vehicles. This would have the potential to impact the logging industry.

NHSTA Proposal

The National Highway Safety Transportation Association (NHSTA) has issued an Advanced Notice of Proposed Rule Making (ANPRM) for improving brake system performance for heavy vehicles. This change could shorten the required stopping distances. A shortened stopping distance increases deceleration forces. With higher deceleration forces, load securement on Michigan's crosswise loaded vehicles should be reviewed. Will two chains be sufficient to restrain a quicker decelerating truck? Will the front rack or stakes be able to withstand the higher forces? Changes in vehicle performance specifications are viewed nationally and there is a possibility that manufacturers will not certify their vehicles for 164,000 lb operation in Michigan.

Wisconsin Professional Training

The Wisconsin SFI Implementation Committee, in cooperation with the Forest Industry Safety and Training Alliance, Inc (FISTA) and the Wisconsin Professional Logger Association (WPLA) have agreed on the requirements needed to be considered a “Qualified Logging or Resource Professional.” For professional training, one of the options is “Log Truck Driver Training” that must be refreshed every two years. The Michigan Professional Loggers Association was formed in 2004 and has discussed the possibility of a similar program where a trucker can earn Sustainable Forestry Initiative credits.

Minnesota

Minnesota has retained its “relevant evidence” provision which allows law enforcement officers to obtain the prior scale weights when a vehicle has been caught overloaded. This law has been changed from previously allowing a review of the past 30 days to a new limit of 15 days.

Canadian "Chip-in-the woods" Processing

In Alberta Canada, there has been a switch in the pulp industry. Instead of hauling logs to a mill where they are processed into chips for fiber, some companies have gone to “chips-in-the-woods.” By processing wood chips in the forest, twelve steps can be eliminated in the typical procedure from tree to processing vat. Hauling chips out of the forests is done with enclosed trailers, eliminating the need for log trucks. However, the chip-in-woods process requires a large investment in mobile processing equipment and quality roads into a logging site. This type of operation may not be suitable for the random, small lot logging that occurs in much of Michigan.

Alberta Canada has developed a program which allows participating mills to utilize heavier load limits, in return for opening up their records to insure that the majority of trucks are within the allowable limits. All trucks coming into the mill are monitored. The goal is to keep the percentage of trucks that are overloaded by more than 2,200 lbs (1,000 kg) down below 2%. If too many trucks are overloaded, then the mill loses its privilege of higher weight limits.

TASK 2 – INVENTORY CHARACTERISTICS/CONFIGURATIONS

Study Area

The study area included all of the Upper Peninsula (U.P.) and the northern half of the Lower Peninsula (L.P.). The south boundary in the L.P. was state highway M-55 which bisects the state from Tawas City on Lake Huron, through West Branch and over to Manistee on Lake Michigan. The study area was divided into five geographical regions. See Figure 2-1.

- Western U.P.
- Central U.P.
- Eastern U.P.
- Northern L.P.
- Central L.P.

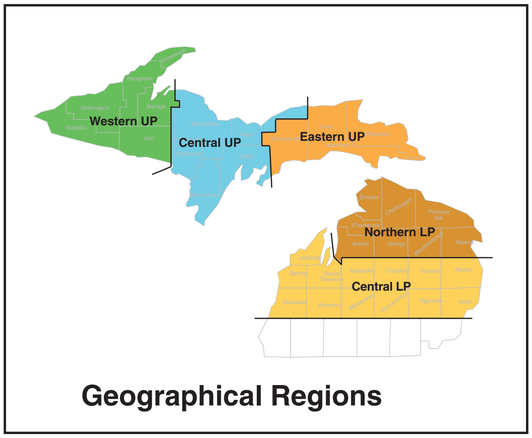


Figure 2-1. Log Truck Inventory Study Areas

For each sighting of a log hauling vehicle, a digital photo was taken and as much information as possible was entered on a Log Truck Inventory Form (see Appendix 3). Photos were taken at various monitoring sites and then analyzed to determine as many characteristics as possible: truck axles, trailer axles, self-loader, log load orientation, securement method, and other features. This information was then transferred into a database for analysis. The photographs and data records were of vehicles using the public roads during daylight hours. Additional information was collected by visiting truck dealers, repair facilities, yards and railroad sidings.

Proposed Monitoring Locations

The assumption that monitoring major mill sites and intersections along major transportation routes would catch most of the log hauling vehicles was incorrect. The timber industry is very dynamic and information from the US Forest Service, Michigan DNR, and the Michigan Economic Development Corporation that was generated a few years earlier did not reflect the current status of the industry.

Competition and market share continually bring changes that affect the flow of timber. MeadWestvaco in Escanaba became NewPage. The Louisiana-Pacific sawmill in Gwinn was bought by Potlatch, a company that previously did not have a presence in Michigan. Some of the Wisconsin and Minnesota mills (StoraEnso and Sappi) changed their paper production methods and became larger consumers of hardwood pulp from the western and central U.P. The use of satellite yards, concentration yards and railroad sidings result in a large number of log hauling vehicles that never enter a mill. See Figure 2-2.

Satellite and Concentration Yards

Satellite yards and concentration yards are sites where wood is collected and stored. The satellite yards are company owned and serve as offsite storage and a buffer for transportation logistics. Some of these sites have railroad access so that logs come in by truck and go out by rail. At other sites a truck-to-truck transfer occurs when the high capacity 11 axle Michigan trucks must be unloaded to 5 and 6 axle trucks for transport into Wisconsin and Minnesota. In the last couple of years there has been an increase in privately owned concentration yards. The private yards have the ability to collect wood from a variety of sources, sort it by species and grade, and then deliver it to whichever customer needs it.

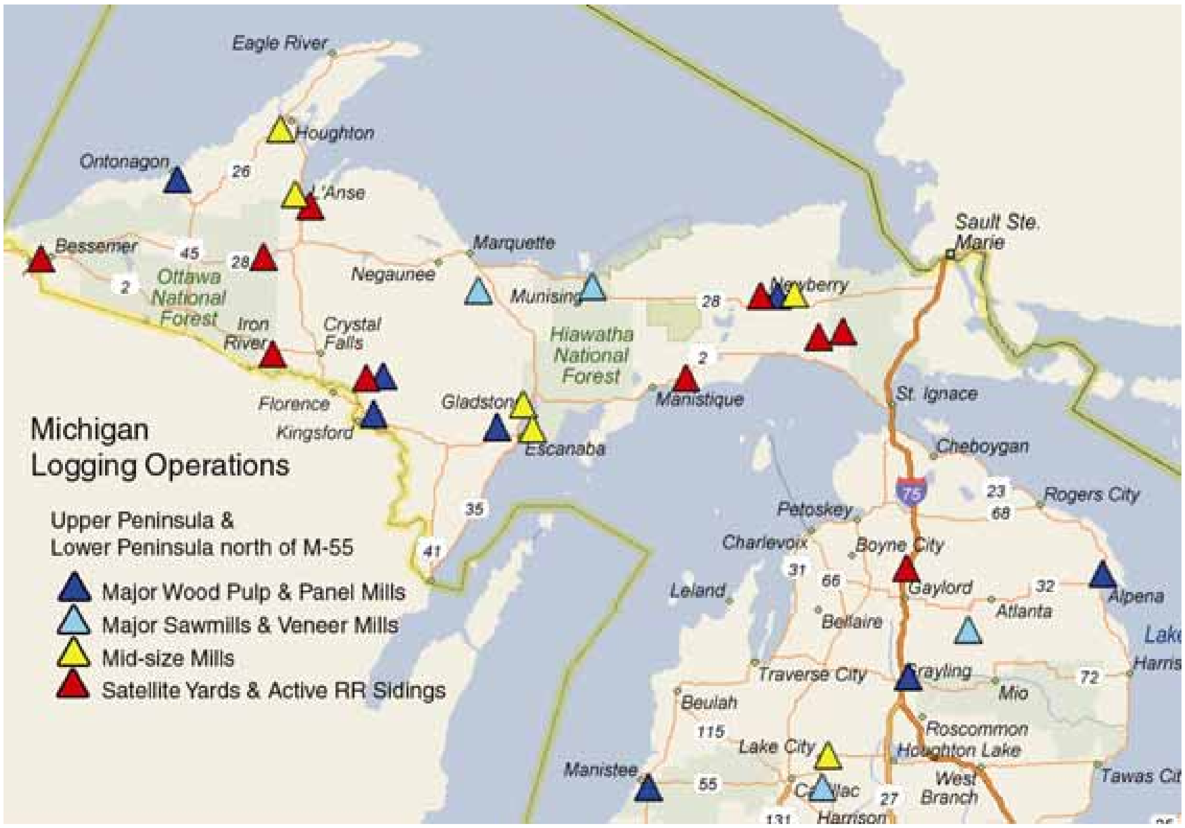


Figure 2-2. Location of Mills and Satellite Yards in the Study Area

PTR Sites Monitored

In addition to the monitoring locations chosen by route analysis, this study was requested to monitor locations near MDOT Permanent Traffic Recorders (PTR) for possible correlation analysis of photographs to PTR data. The five PTR sites monitored were:

- Station 1529 in Norway
- Station 1449 in Bark River
- Station 2229 in Rapid River
- Station 4089 outside of West Branch/Prudenville
- Station 4049 in Vanderbilt

Station 2209 in Deerton, on M-28 west of Munising, was not monitored. This section of road was under re-construction during most of the summer of 2005. Additionally, this road is not a common truck route for log haulers. A brief two-hour visit was also made to Station 4129 in Houghton Lake on US-27, but traffic volume was very low.

A photograph was taken of almost every log truck that was recorded at the monitoring site. These photographs were time stamped for correlation to the recorder data.

Appendix 4 contains Excel files that include time, direction, and type of log truck. At all locations the total number of axles were recorded. At Bark River, Rapid River, West Branch and Vanderbilt, the number of lifted axles were also recorded. This should allow correlation with traffic recorder data. The PTR count only included axles on the road. For example, an empty Michigan combination rig with a total of eleven axles, but with four axles lifted, is counted as an 11 axle vehicle in this report, but the PTR traffic recorder would categorize it as a 7 axle vehicle.

Notes in the spreadsheet describe the monitoring location and the distance from the permanent traffic recorder. A time correction factor can be applied to the times recorded at the monitoring site for an approximation of when the vehicle crossed the traffic recorder. An analysis of this data was not within the scope of this project.

Data Collection

The inventory of log hauling vehicles was based on photographs. The basic information that was to be determined for each vehicle was: number of truck and trailer axles, axle spacing (9 foot spreads), GVWR, self loader and crosswise or lengthwise loading. This information was generally easy to obtain during daylight hours. A more difficult task was to identify the vehicle’s registration state. In most instances dirty, or bent plates, or plates that were not visible from the monitoring location, or clear enough due to the vehicle movement, prevented determination of the vehicle’s origin. When vehicles were parked, photographs allowed gathering additional information about the vehicle. The owner’s name, hometown, USDOT number, license plate numbers, log tag, vehicle colors, nicknames on the rack or windshield, and type of securement system were useful information for future identification. However, only while a vehicle was parked could a complete set of photos be taken.

With vehicles traveling at 55 mph (81 feet per second) at most of the permanent traffic recorder monitoring locations, one good broadside photograph was usually considered a success.

A Panasonic FZ-3 digital camera with a 12x optical telephoto lens was used for the study. A photo could be taken of the entire vehicle and then a close-up of the door information and/or license plates could be obtained with the high zoom capability. Another useful camera feature was the “burst mode” which took up to seven photos in one second, greatly increasing the possibility of getting a good photo of a moving vehicle. Image stabilization built into the camera provided clear photos even at the high magnification.

Vehicle Configurations

Log hauling vehicles in Michigan come in a wide variety of configurations and sizes. If it is possible to haul logs on a particular configuration, someone probably has tried it. According to several heavy truck dealers there is no such thing as a standard log truck and trailer. Every vehicle is a custom setup. Truck and trailer configurations vary depending on location (especially if crossing state lines), typical road conditions (off-road use versus interstate highway), and type of load (sawlogs versus pulpwood). Some rigs are designed for a special purpose such as longer distance highway transport from a yard to mill. Other setups are designed for maximum flexibility so that on one load they can carry crosswise loaded pulpwood and the next load can be random length, lengthwise loaded, saw logs. The configurations are constantly evolving as new technology becomes available and operators strive for greater productivity and efficiency.

The two broad classes of log hauling vehicles are the tractor and semi trailer combination and the truck and trailer combination. A third configuration, B-trains, with a tractor and two semi trailers was occasionally observed.

Tractors and Semi Trailers

Every tractor and semi trailer combination observed during this study was powered by a 3 axle tractor. Although 2 axle tractors are used in some semi trailer applications, they are not practical in the log hauling business because of their reduced load capacity. For the purpose of the following discussion on maximum Gross Vehicle Weight Ratings (GVWR), the standard 3 axle tractor was assumed to be rated at 47,400 pounds (15,400 lb steer axle and 16,000 lb for each drive axle). The axle ratings are based on a 700 pound per inch of tire width, so the 15,400 pound steer axle rating assumes an 11 inch tire width. The steer axle can be a maximum of 18,000 pounds if equipped with 13 inch wide tires.

Although all the tractors were similar, the semi trailers varied considerably from conventional 2 axle flatbed trailers up to 8 axle special purpose log haulers.

3+2 Combination

Figure 2-3. Standard 80,000 pound rig, 3 axle tractor with a conventional 2 axle flatbed semi trailer

The 3 axle tractor with a conventional 2 axle flatbed semi trailer is considered to be the standard 80,000 pound rig. In Figure 2-3, a flatbed trailer was converted into a crib style log hauler by adding side stakes and end gates to the front and rear. The four bunks of lengthwise loaded pulpwood are secured with two nylon straps per bundle.

Figure 2-4. A 3 axle tractor with a conventional 2 axle flatbed semi trailer with axles nine feet apart

By spreading the trailer axles to at least nine feet apart as shown in Figure 2-4, the GVW can be increased to 83,400 pounds. The spread axle trailers are commonly seen in many tractor/semi trailer combinations. This load of crosswise loaded pulpwood was secured with two chains. The chains wrap around center stakes, which are required on trailers over 33 feet long.

Figure 2-5. Dedicated log hauler with loader

When dedicated to log hauling, a loader can be added to the center of the trailer. The crib style trailer shown in Figure 2-5 has four bunks of lengthwise loaded pulpwood that were secured with a combination of nylon straps and chains.

3+3 Combination

Figure 2-6. A 3+3 combination

More load capacity can be obtained by adding more axles. When the three trailer axles are grouped together, as shown in Figure 2.6, the GVW is 86,400 pounds.

Figure 2-7. A 3+3 adjusted for greater load capacity

Spreading one axle out by nine feet, as shown in Figure 2-7, increases the capacity by 5,000 pounds to 91,400 pounds.

Figure 2-8. This arrangement increases the load capacity to 101,400 pounds

Spreading all three axles, as shown in Figure 2-8, raises the GVWR to 101,400 pounds. Almost every 3 axle log hauling semi trailer observed during this study had a loader.

3+4 Combination

Figure 2-9. A 3+4 combination with four lengthwise loaded bunks

A 4 axle semi trailer with one spread axle, as shown in Figure 2-9, can be rated up to 104,400 pounds. This vehicle did not have a loader and was lengthwise loaded in four bunks. But because this configuration does not include a front gate or end gate on either the truck or the trailer it is not a crib style trailer.

Figure 2-10. A 4 axle trailer being unloaded by adjacent truck

A 4 axle semi trailer with all the axles on nine foot spreads, shown in Figure 2-10, has a GVW of 119,400 pounds. Without its own loader, this configuration of log hauler needs to be loaded and unloaded by an adjacent log truck.

3+5 Combination

Figure 2-11. A 3+5 combination

This 5 axle semi trailer with one axle spread nine feet, as shown in Figure 2-11, would be rated at 117,400 pounds. The trailer had a center mounted loader and a mixed load of random length saw logs with some logs loaded crosswise and others lengthwise.

3+6 Combination

Figure 2-12. A 3+6 Combination

A 6 axle semi trailer with one spread axle, as shown in Figure 2.12, has a GVWR of 130,400 pounds. This semi trailer has a center mounted loader and was hauling pulpwood crosswise loaded.

3+7 Combination

Figure 2-13. A 3+7 Combination

A 7 axle semi trailer with one spread axle, as shown in Figure 2-13, can be rated for a GVW of 143,400 pounds. This particular trailer also has a center mounted loader and was hauling pulpwood crosswise loaded.

Figure 2-14. A 7 axle trailer with two axles at nine foot spread

A 7 axle semi trailer with two axles at nine foot spreads, as shown in Figure 2-14, has a load capacity of 148,400 pounds. Note that this load contains five bunks of lengthwise loaded logs that were secured with two nylon straps per bundle. But because this configuration does not include a front gate or end gate on either the truck or the trailer it is not a crib style trailer.

3+8 Combination

Figure 2-15. A 3+8 Combination

The 11 axle tractor/semi trailer combination, shown in Figure 2-15, hauling crosswise loaded pulpwood can be rated to 151,400 pounds if none of the axles are spread.

Figure 2-16. An 8 axle crib style trailer with one axle on a nine foot spread

This 8 axle semi trailer with one axle on a 9 foot spread, shown in Figure 2-16, would be rated at 156,400 pounds. Note that this is a crib style trailer with lengthwise loaded sawlogs. Because this configuration <u>does</u> include a front gate and end gate on either the truck or the trailer, it is a crib style trailer.

Trucks and Trailers for Log Hauling

As with the tractor and semi trailer combinations, the truck and trailer combinations are just as numerous. The trucks range from 3 axles up to 7 axles. Trailers (usually referred to as “Pups”) range from 2 axles to 5 axles. Most of the trucks have the large “super single” tires on the front axle in order to get an 18,000 pound steer axle rating. Every truck and trailer combination was equipped with a loader mounted to the rear of the truck. Frequently the height of crosswise loaded logs will taper down to the rear of the truck. This is because the loaders are so heavy the axle ratings would be exceeded if a full stack of logs were loaded.

3 Axle Trucks

Figure 2-17. A 3 axle truck and a 2 axle trailer

The 3 axle truck pulling a 2 axle trailer shown in Figure 2-17 was the smallest truck and trailer combination observed in the study. A 3 axle truck has a maximum GVW of 50,000 and the 2 axle trailer has a rating of 36,000 pounds, for a CGVWR of 86,000.

4 Axle Trucks

Figure 2-18. A 4 axle truck and 2 axle trailer

The 6 axle combination of a 4 axle truck and 2 axle trailer, shown in Figure 2-18, was seen frequently, especially near the Wisconsin border (WI regulations stipulate a maximum of 6 axles). Every 4 axle truck observed during the study had a spread second axle, which would allow a rating of 68,000 pounds. With a 2 axle trailer the combined weight rating is 104,000 pounds.

Figure 2-19. A 7 axle combination truck and trailer

Three separate rigs were seen with a 4 axle truck pulling a 3 axle trailer. All the trailer axles were on 9-foot spreads, producing a 54,000 pound trailer rating. The 7 axle combination shown in Figure 2-19 had a CGVWR of 122,000 pounds.

5 Axle Trucks

Figure 2-20. A older 5 axle truck with a 2 axle trailer

The older 5 axle trucks, pre-1990, as shown in Figure 2-20, have a 4 axle grouping in the rear for a maximum GVW of 70,000 pounds. With a 2 axle trailer the CGVWR is 106,000 pounds.

Figure 2-21. A newer 5 axle truck and 3 axle trailer

The newer 5 axle truck, shown in Figure 2-21, spread the second axle to get up to 75,000 pounds. They usually were pulling larger trailers also. With a 54,000 pound 3 axle trailer the combined rating could be 129,000 pounds.

Figure 2-22. A 10 axle combination, 5 axle spread on the truck and 5 axles on the trailer

A spread 5 axle truck with a 71,000 pound 5 axle trailer, as shown in Figure 2-22, can have a CGVWR of 146,000 pounds.

6 Axle Trucks

Similar to the 5 axle trucks, the 6 axle trucks are divided into those with a rear axle grouping and those with a spread axle. The 6 axle truck with a five axle grouping shown in Figure 2-23 has a GVW of 83,000 pounds. With the second axle on a 9 foot spread the rating increases to 88,000 pounds.

Figure 2-23. A 6 axle truck with 3 axle spread trailer

A few 6 axle trucks were seen with the three spread axle trailers with a 54,000 pound GVW. The rig shown in Figure 2-23, shows a 6+3 crosswise loaded with pulpwood that could be rated at 137,000 pounds.

Figure 2-24. A 10 axle combination, 6 axle truck and 4 axle trailer

Several rigs were seen with 4 axle trailers that had a tandem axle dolly and two spread axles for a GVW of 68,000 pounds. The 4 axle trailer shown in Figure 2-24 was actually a 2 axle semi trailer with a tandem axle converter dolly.

Figure 2-25. An 11 axle combination, 6 axle truck and 5 axle trailer

The 6 axle trucks were most often seen pulling a 5 axle trailer for a CGVWR of 154,000 pounds.

Figure 2-26. Variation of the 10 axle combination, note the axle spread for increased GVWR

Many of the 6 axle trucks have the second axle on a 9 foot spread to increase the trucks GVWR up to 88,000 pounds. The 6S4 (S designates spread) 10 axle combination shown in Figure 2-26 could have a CGVWR of 156,000 pounds.

Figure 2-27. Second largest log hauling combination in Michigan

The 11 axle combination of a spread 6 axle truck and a 5 axle trailer, shown in Figure 2-27, is one of the more common rigs seen on Michigan roads. At a CGVWR of 159,000 pounds, this combination is the second largest log hauling rig in Michigan.

Figure 2-28. This 11 axle combination has a new style loader behind the truck

The rig shown in Figure 2-28 is another 6S5 combination. This vehicle had a relatively new style loader that folds up behind the truck instead of having the boom extended over the load as seen on most trucks.

7 Axle Trucks

Figure 2-29. This 11 axle combination is the largest capacity log hauler on the road

The largest capacity log hauling truck is the 7 axle truck shown in Figure 2-29. With a GVW of 96,000 pounds it was often seen with a 4 axle trailer (with two spreads). With a Combined Gross Vehicle Weight Rating of 164,000 pounds it is the largest vehicle in the Michigan log hauling fleet.

B-Trains

B-trains are a tractor with two semi trailers. The lead trailer has a hitch that allows the second semi trailer to attach in the same manner that it would attach to a tractor.

The rigs shown in Figures 2-30 and 2-31 show a B-train that had been separated in order to be legal in Wisconsin, which allows only six axles. The tractor was first seen with the lead semi trailer. Note the hitch in the rear. A few hours later the tractor was seen with the second semi trailer.

Figure 2-30. B-train, tractor with 3 axle semi trailer and additional hitch

Figure 2-31. Same B-train tractor with 2 axle semi trailer

B-trains are considered to be a more stable multi-trailer combination. The conventional semi trailer hookup for the second semi trailer greatly increases the roll stability of the trailing semi trailer.

B-trains come in a variety of configurations from 9-11 axles. They are more commonly used for longer hauls on interstate highways. B-trains are seldom equipped with a loader, but there were some with a loader mounted at the rear of the lead trailer. Occasionally B-trains will be used to haul logs into a mill and then load up with finished products for the outbound trip.

Figure 2-32. A 9 axle B-train with 4 axles on 9 foot spreads

The 9 axle B-train with six bundles of lengthwise loaded logs shown in Figure 2-32 could have a CGVWR of 145,400 pounds (assuming a 15,400 pound steer axle). The 4 axles on 9 foot spreads increased the capacity of this configuration.

Figure 2-33. A 10 axle B-train crosswise loaded with pulp

The 10 axle B-train with crosswise loaded pulpwood, shown in Figure 2-33, may be rated for 143,400 pounds.

Figure 2-34. This 11 axle B-train with random length saw logs has a CGVWR of 161,400 pounds

The 11 axle B-train with random length saw logs, shown in Figure 2-34, has a CGVWR of 161,400 pounds.

Monitoring Site Results

Summary of Sightings at Stationary Monitoring Sites

Over 1,000 sightings of log hauling vehicles were recorded and over 3,000 photographs were taken during the course of this study. Approximately half of the sightings were while monitoring stationary sites. The remaining sightings were of vehicles parked in restaurants, repair facilities, or loading and unloading in yards. The following statistics are presented for the stationary monitoring sites.

Table 2-1 is a chronological summary of the stationary monitoring sites. Note that all but one site was monitored on either Wednesday or Thursday.

Table 2-1. Monitored Sites by Day

Date	Monitoring Location	Duration (Hr:min)	Log Trucks	Loaded/ Empty	Frequency Of Log Trucks (min:sec)
Wednesday, May 04, 2005	Ironwood	4:55	17	7/10	17:21
Thursday, May 05, 2005	Ironwood	1:17	10	4/6	7:42
Thursday, May 05, 2005	Iron River	2:37	24	9/15	6:32
Friday, May 06, 2005	Sagola	2:40	31	18/13	5:10
Tuesday, May 24, 2005	Norway PTR	12:08	44	22/22	16:33
Wednesday, May 25, 2005	Quinnesec	5:49	59	27/32	5:55
Thursday, May 26, 2005	Sagola	1:42	22	8/14	4:38
Tuesday, May 31, 2005	Grayling	4:05	24	14/10	10:12
Thursday, June 02, 2005	West Branch PTR	12:00	29	14/15	24:50
Wednesday, June 22, 2005	Vanderbilt PTR	11:59	58	29/29	12:24
Thursday, July 14, 2005	Rapid River PTR	12:20	137	69/68	5:24
Wednesday, July 27, 2005	Bark River-Harris PTR	12:26	66	28/38	11:18

A total of 521 log hauling vehicle sightings make up the Table 2-1 database. Two-thirds of the monitoring time was in the Upper Peninsula; which accounted for 79% of the vehicles recorded. One-third of the monitoring time was in the Lower Peninsula where 21% of the vehicles were observed. As would be expected, about half the vehicles were loaded (249) and half were empty (272).

Comments:

The Norway PTR had a relatively low volume of only 44 log hauling vehicles in a twelve hour period. This seemed odd with the International Paper mill (second largest mill in the U.P.) just a few miles to the west. However, the following day while monitoring the US-2 and Lake Antoine Road intersection to the west of the mill; 59 vehicles were seen in less than 6 hours (an average of one log truck sighting every 6 minutes).

In the Lower Peninsula, at the West Branch PTR on I-75 at the south end of the study area, only 29 log hauling vehicles were observed in a 12 hour period; which is an average of almost 25 minutes between sightings. Moving north to the Vanderbilt PTR on I-75 saw the log truck volume doubles to 58 trucks in 12 hours. At I-75 south of Grayling, in between the two PTR sites, the frequency of log trucks increased to 24 vehicles in 4 hours. The log truck traffic in the Grayling area was high because of the Weyerhaeuser mill which was the largest pulpwood consuming mill in the Lower Peninsula.

The greatest number of log hauling vehicle sightings occurred at the Rapid River PTR north of Escanaba and north of the largest mill in Michigan (NewPage, formerly MeadWestvaco). In a 12 hour period 137 log trucks were seen, for an average of one log truck every 5 ½ minutes.

Summary of Log Truck Types Observed at Stationary Monitoring Sites

There were 521 log hauling vehicles clearly identified at monitoring sites, Table 2-2 presents the distribution of log trucks by vehicle configuration.

Table 2-2. Configurations by Monitored Site

Date	Location	7 axle	6 Spread	6 axle	B-Trains	3+2	Others
5/4/05	Ironwood	1	1	0	0	8	7
5/5/05	Ironwood	0	1	0	0	4	5
5/5/05	Iron River	5	0	5	0	9	5
5/6/05	Sagola	11	4	5	0	3	8
5/24/05	Norway PTR	8	6	8	0	4	18
5/25/05	Quinnesec	17	18	9	0	8	7
5/26/05	Sagola	9	4	6	0	1	2
5/31/05	Grayling	7	4	6	1	0	6
6/2/05	West Branch PTR	0	1	12	9	1	6
6/22/05	Vanderbilt PTR	6	13	15	9	0	15
7/14/05	Rapid River PTR	36	23	52	2	3	21
7/27/05	Bark River-Harris PTR	24	11	19	4	2	6
	Totals	124	86	137	25	43	106
	Percentages	24%	17%	26%	5%	8%	20%

Overall, 67% of the sightings were 11 axle truck plus trailer Michigan rigs.

- 39% of those were the conventional 6 axle truck with a 5 axle trailer combination with a CGVWR of 154,000 pounds.
- 36% of those were the 7 axle truck with 4 axle trailer at a CGVWR of 164,000 pounds.
- 25% of those were the 6 axle truck with 9 foot spread and 5 axle trailer at CGVWR 159,000 pounds.

Around Escanaba, at the Bark River-Harris and Rapid River PTR's, the 11 axle Michigan rigs accounted for 81% of the log truck traffic. But at the other extreme, no 11 axle Michigan rigs were seen on I-75 in West Branch.

Less than 8% of the log-hauling vehicles were the common 5 axle tractor and semi trailer combination. Only one of these rigs was recorded in the L.P. However, in Ironwood and Iron River they accounted for roughly 40%. This is due to the lower weight limits and axle counts in Wisconsin and Minnesota. Around the International Paper mill in Quinnesec, which is also near the Wisconsin border, the 3+2 tractor semi trailers accounted for only 12% because larger trucks generally serve the pulp mill.

In West Branch, almost 1/3 of the log-hauling vehicles were B-trains. At Vanderbilt 15% of the log trucks were B-trains. At monitoring sites in the Upper Peninsula, no B-trains were seen.

Log Trucks as a Percentage of All Truck Traffic at PTR Sites

At the PTR monitoring sites, except for Norway, all the truck traffic was recorded. For the purpose of this study, only large heavy-duty trucks were counted; buses and 3 axle trucks, i.e. dump trucks and garbage trucks were not included in these truck totals. Over 91% of the trucks under this definition had five axles or more. Table 2-3 presents the quantity of log trucks versus the total number of trucks on the road.

Table 2-3. Percentage of All Truck Traffic

Date	Location	Duration (Hr:min)	All Trucks	5 axles or more	Log Trucks	Log Trucks %	Frequency of Trucks (min:sec)
6/2/05	West Branch PTR	12:00	773	743	29	3.8%	00:56
6/22/05	Vanderbilt PTR	11:59	735	671	58	7.9%	00:59
7/14/05	Rapid River PTR	12:20	721	692	137	19.0%	01:02
7/27/05	Bark River-Harris PTR	12:26	335	309	66	19.7%	02:14
	TOTALS	48:45	2,564	2,415			01:08

At West Branch, Vanderbilt and Rapid River the truck traffic was very similar with around 700 trucks being recorded in a 12 hour period, or roughly one truck per minute.

Other Results from the Monitoring

The results presented in the previous sections were for the stationary monitoring sites– the observer stayed in one location and photographed all the log hauling vehicles moving past. In addition to these stationary records, there were many other log truck sightings. During trips to logging conferences and safety inspections, short stays at major intersections, scouting near PTR locations and visits to dealers, numerous other log hauling vehicles on the roads were observed and recorded.

By combining all log hauling vehicles from the stationary and secondary sightings, the database increased to 885 records. In 636 of these records the number of axles could clearly be identified. Of these, 523 or 82% were the 11 axle truck trailer combinations. This was higher than the 67% that was quoted for the stationary monitoring sites. The difference was most likely due to more time being spent in the U.P. and a higher concentration of the larger log trucks in the U.P. The breakdown for 11 axle truck trailer combinations was: 7+4 (34%), 6 S 5 (29%), and 6+5 (37%). Self loaders were on 95% of the trucks.

Loading Orientation

The study clearly identified 338 loaded trucks; in this group, 86% were crosswise loaded, 12% lengthwise loaded, and 2% had a mix of both crosswise and lengthwise loading. Of the 404 loaded trailers; 80% were crosswise loaded, 19% lengthwise loaded, and 2% had a mix of both crosswise and lengthwise loading.

Securement

When the load securement method could be identified it was tracked for analysis. On trucks, 92% used chains and 8% used straps. On trailers, 84% used chains and 16% used straps. 46% of the trucks and 47% of the trailers of the loaded vehicles were identified as crosswise loaded and secured with chains.

Vehicle Origin

An effort was made to determine the origin of the vehicle (state where licensed). This proved to be extremely difficult. In only 12% of the photographs could the license plate be positively identified. Therefore, calculating statistics from such a small portion of the total sample would be unreliable.

Size of the Michigan Log Truck Fleet

Several estimates on the size of the log truck fleet were made from; data gathered during this study; through consultations with mill officials, operators, and insurance companies; and data obtained from the Information Services Division of the Michigan Department of State. There is no organization to which log truckers belong. The Michigan Association of Timbermen publishes a forestry directory that contains many of the mills and logging companies in Michigan, but this is a list of members only and many truckers are not listed. In Michigan, log hauling trucks are not uniquely identifiable through vehicle registration. Although there is a "LOG FARM" tag, not all log haulers are registered, or required to register, under this category.

The sole reason for registering a vehicle under a log plate is the fee. An 11 axle, 164,000 pound rated log truck plus trailer combination with a log plate pays annual registration fees of less than $600 per year, while the cost for a commercial plate for a vehicle with an elected gross weight over 160,000 pound is $3,117 per year. The log plates are cheaper because the Michigan Vehicle Code, PA 300 of 1949, 257.801(1)(d) (see Appendix 5), identifies a special wood harvester registration rate of $0.74 per 100 pounds of the *empty* weight of the road tractor, truck or truck tractor. The empty weight of a typical 6 axle log truck with self loader is less than 40,000 pounds, resulting in an annual Log Plate fee of less than $300. If that same 6 axle truck was to be plated with an elected gross weight of 88,000 pounds its registration fee would be $1,793. The log trailers fall under the "lifetime trailer plate" registration fee which is a one time $300 fee until the trailer title is transferred.

During the inventory data gathering process, there were 125 identifiable license plates, of which 45 were agricultural log truck license plates and the remaining 80 were commercial truck license plates. Using this data we can estimate that 36% of all log trucks would have agricultural log truck license plates and 64% would have commercial truck plates.

The Michigan Department of State provided a database for all vehicles using the agricultural log truck license plates. The database was queried for vehicles that fit the weight and body style categories that are consistent with a log trucks. Results indicate that there are 377 log trucks in the State registered under the agricultural log truck plate. Applying the 36/64 ratio of log truck plates to commercial plates developed from the sightings during the inventory, to the 377 registered vehicles using log truck license plates, gives a total estimated log truck fleet size of 1,047 vehicles statewide. The Secretary of State registration data indicates that approximately 66% of the log truck fleet is based in the Upper Peninsula, while 34% of the fleet is located in the Lower Peninsula.

Another method used to estimate the number of log trucks was based on phone interviews with insurance companies in Michigan and Northern Wisconsin. According to interviews with representatives of the Michigan Forest Insurance Center and other insurance agents, there are few insurance companies that will extend insurance policies for log trucks. The vast majority of mainstream insurance companies (AAA, All State, Freemont, Allied, etc.) will not insure log trucks. This is as specialty market. Seventeen interviews with insurance providers in Michigan and Northern Wisconsin verified that only six insurance carriers are known to extend insurance for log trucks: Secura Insurance, Bituminous Insurance, Progressive Insurance, Farm Bureau Insurance, Acuity Insurance of Cheboygan Wisconsin, and National Indemnity.

The six insurance companies were surveyed and results indicate a total of 920 log trucks are currently insured in Michigan. This number correlates well to the fleet size estimated from the Michigan Department of State data, which indicated a state fleet size of 1,047.

In a third estimate, the U.S. Forest Service reports 4.5 million cords of wood are harvested annually in Michigan. Discussions with loggers at the U.P. Log Truck Safety Inspections indicated that drivers strive for 400 loads per year and an average of 2 loads per day for each truck. They haul on average 17 cords per truck. Using a mathematical calculation to determine the order of magnitude it would require a minimum of 661 trucks to move the recorded amount of timber harvested each year.

The best estimate is that at least 800 log trucks are active in Michigan in 2005. Approximately 75% of these vehicles are the 11 axle truck trailer combinations. The photographic database created during the inventory phase of this study, positively identified 373 unique vehicles during the twenty days of observation.

The Michigan log hauling fleet is constantly changing. Some of the larger trucking firms buy one or two new rigs each year, use them for five years and then sell the used truck to a small independent operator. In September 2005, approximately 100 log trucks left the region to assist in Hurricane Katrina clean-up efforts. The demand for logs at the mills does not change, so it is expected that old trucks will be brought out of retirement, flatbed semi trailers may become log haulers and trucks may come in from the surrounding region. At the annual Logging Congress in Marquette, 12 new trucks were on display, 9 of which were ready for delivery to their new owners.

TASK 3 – LOG TRUCK CRASH ANALYSIS

Methodology

When a crash is reported in Michigan the investigating police officer will complete a UD-10 Form that summarizes information on the crash. The data from these forms is then entered into a State crash database for summary and presentation of information related to trends and characteristics of crashes in the state. The analysis for Task 3 of this study focused on a three-year period, 2001-2003, involving log truck crashes in the Upper Peninsula (U.P.).

The Michigan Crash Database was queried for truck or bus crash records in the U.P. where the vehicle weighed 10,000 lbs or more. From these 1,450 records, a review was done by hand to determine if one of the vehicles was a log truck. The reviewers looked for identifying information that would indicate a log truck, such as: name of the trucking company, location of the crash, the diagram of the crash, axle configuration, insurance carrier, and US-DOT number. In cases where the UD-10 Form did not provide sufficient information to determine if the vehicle was a log truck, the Federal Motor Carrier Safety Administration (FMCSA) Safety and Fitness Electronics Records System (SAFER) database was used to identify the type of cargo hauled by the vehicle based on its US-DOT tracking number. Many records where eliminated as potential log truck crashes based on the cargo type listed in the SAFER database. When the SAFER database listed "logs, poles, beams, lumber" as the cargo type, phone calls were made to individuals involved in the crash to inquire if the vehicle was a log truck. In a limited number of cases (14 records) where no phone contact could be made with a participant in the crash, the engineer reviewing the records made a judgment call based on the available information from the UD-10 form, the SAFER database, as well as other information about the trucking company that could be collected.

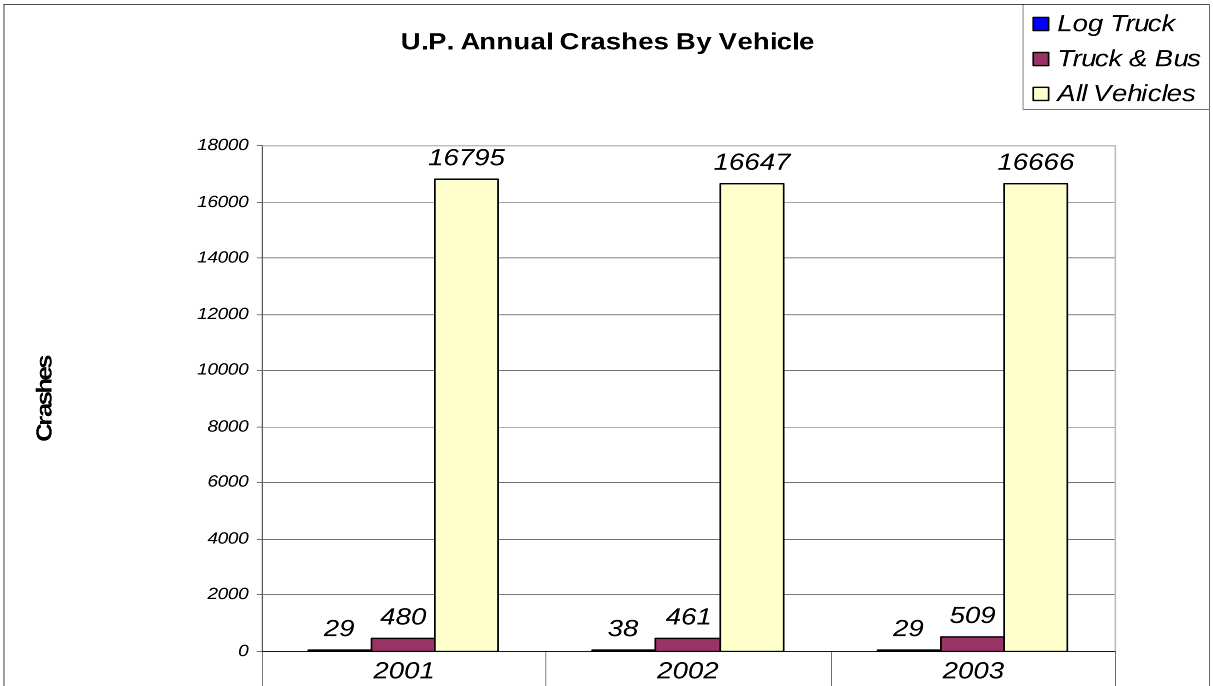
Once the U.P. log truck crash records were identified, several summaries were prepared to provide an understanding of the characteristics of these crashes. In order to provide a basis for comparison, crash data summaries were also prepared for all traffic in the U.P., and for heavy truck or bus traffic in the U.P. (vehicle type = "truck/bus").

Crashes in the U.P.

Over the three-year period, there were 50,108 reported crashes in the U.P. Of these, 1,450 (2.9%) involved at least one truck or bus as identified on the UD-10 Form. Of those, 96 crashes involved a log truck. This represents 6.6% of the truck/bus data set and 0.19% of the all-traffic in the U.P. data set. It should be noted that the truck/bus data set is a subset of all-crashes, and the log truck data set is a subset of truck/bus data set, but neither subset is large enough to significantly influence the parent data set. These numbers indicate an average of approximately 16,700 total U.P. crashes per year, of which 483 per year involved a heavy truck or bus and 32 per year involved a log truck. Figure 3-1 shows a graph of comparative annual frequencies in the U.P. of log truck crashes, truck/bus crashes and all-vehicle crashes.

Log truck crashes in the U.P. were compared with traffic related crashes involving trains, school buses, pedestrians, off road vehicles (on the road system) and snowmobiles (on the road system) to provide a scope of the incidence of log truck crashes. Figure 3-2 shows this comparison.

Based on the total number of crashes, log truck crashes in the Upper Peninsula appear to be relatively infrequent and account for a small percentage of all truck and bus crashes and an even smaller percentage of the total crash record.



	2001	2002	2003
Log Truck	29	38	29
Truck & Bus	480	461	509
All Vehicles	16795	16647	16666

Figure 3-1. Annual Crashes by Vehicle in the U.P.

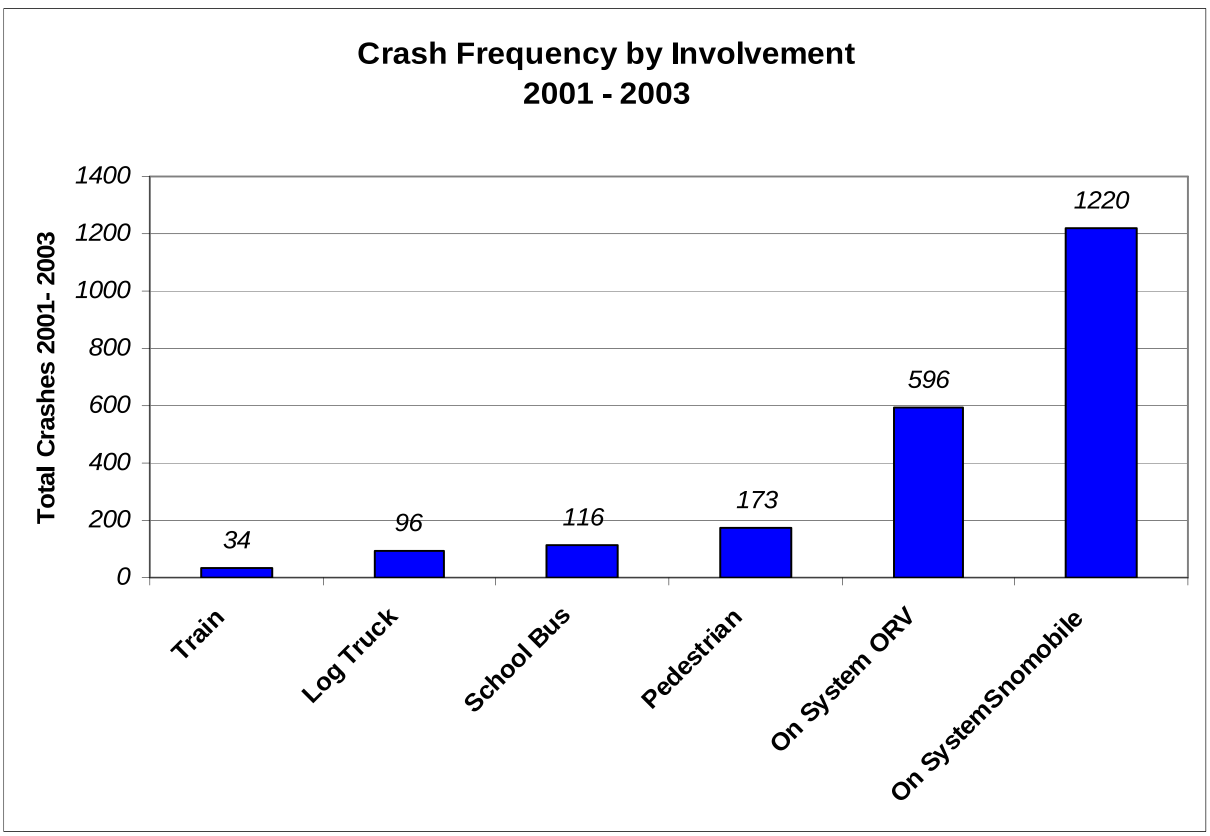


Figure 3-2. Crash Frequency by Involvement

Crashes Involving a Log Truck in the U.P.

A review of the 96 crashes indicated that 25% involved a log truck only, 64.6% involved a log truck and another vehicle, and 10.4% involved a log truck and an animal, usually a deer. Generally speaking, log truck involvement appears very similar to the overall heavy truck and bus crash trends in the U.P. (Figure 3-3).

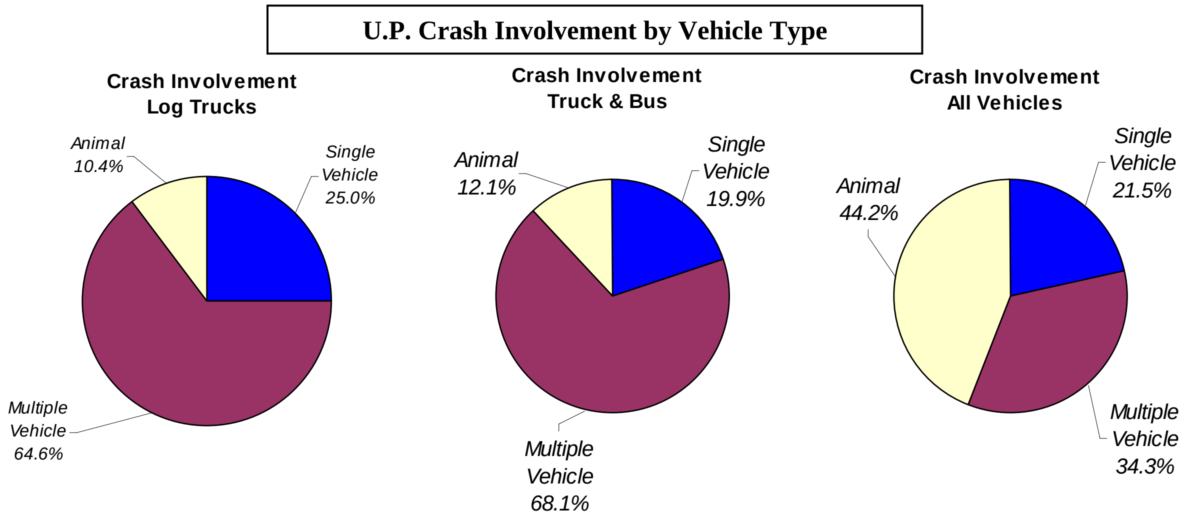


Figure 3-3. U.P. Crash Involvement by Vehicle Type

Crashes Involving a Log Truck in the U.P. by Month of the Year

The distribution of the 96 log truck crashes that occurred in the U.P. between 2001 and 2003 are plotted by month in Figure 3-4 and Figure 3-5. As a basis of comparison, Figure 3-4 shows log truck crashes and all-crashes in the U.P. as a time series. Figure 3-5 shows log truck crashes, and truck and bus crashes in the U.P. also as a time series.

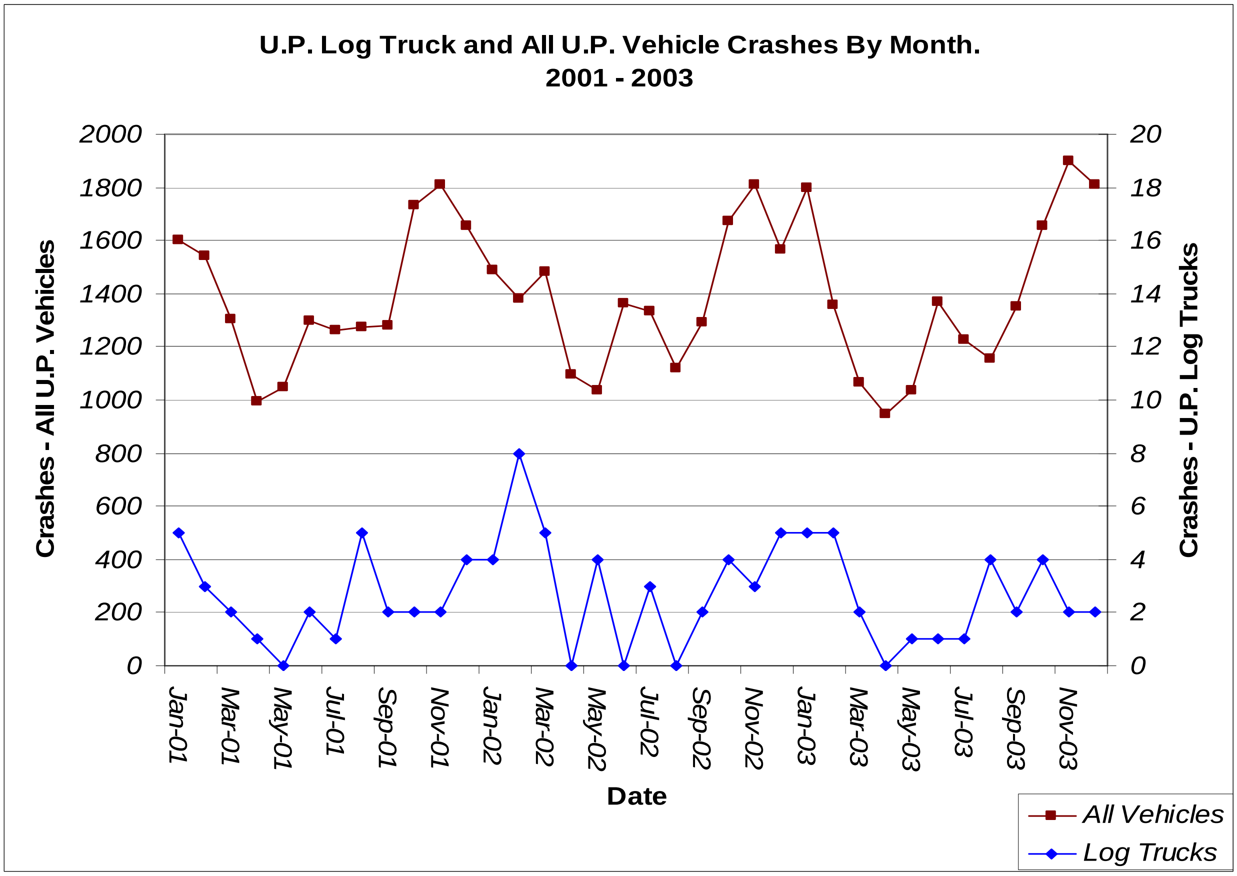


Figure 3-4. U.P. Log Truck and Vehicle Crash History

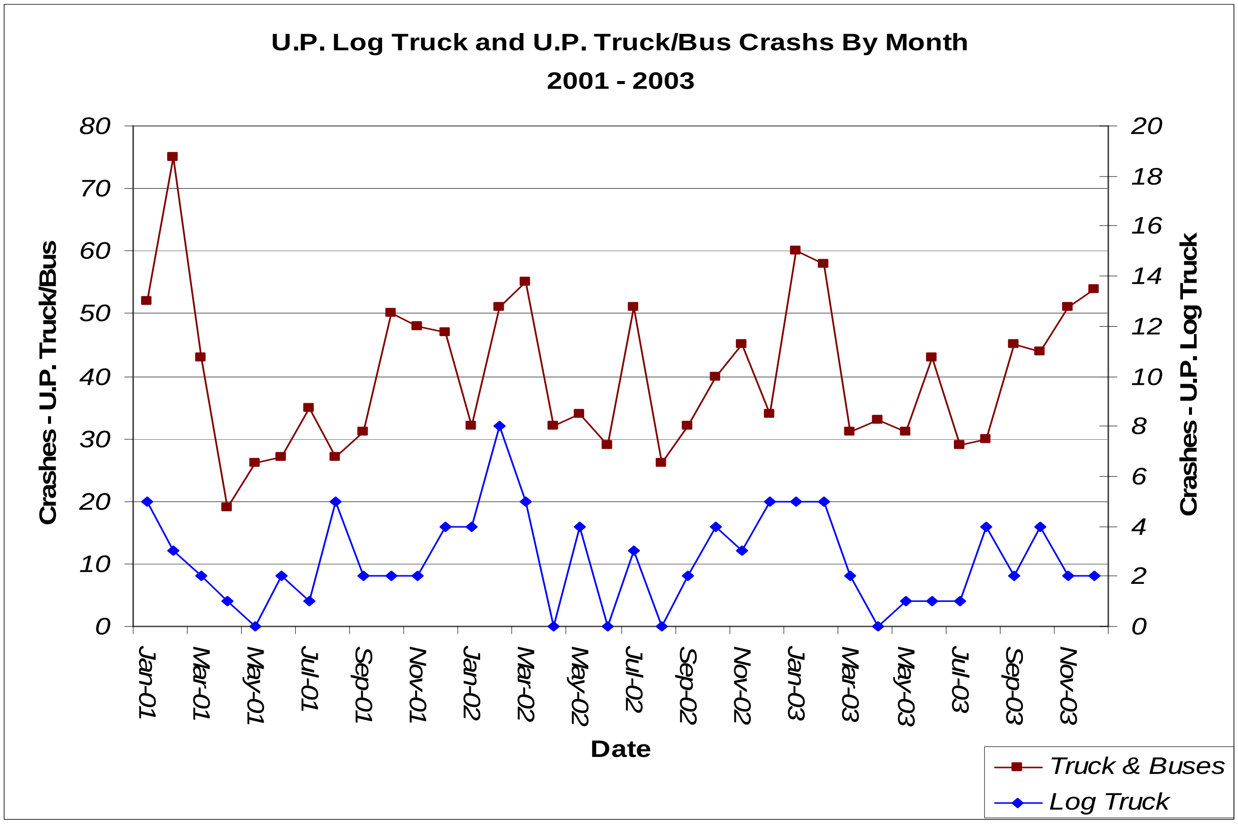


Figure 3-5. U.P. Log Truck and Truck/Bus Crash History

Figure 3-4 and Figure 3-5 show a slight correlation between the months that log truck crashes occur and the two other crash types in the Upper Peninsula. It is important to note that there are cyclical annual variations that occur with log truck crashes that are similar to the annual variations that occur with the truck/bus sub-set and all-crashes. From this stand point it can be stated that log truck crashes do not vary significantly from other crashes as far as the nature of their distribution through the year.

Crashes Involving a Log Truck in the U.P. by Time of Day

Figure 3-6 and Figure 3-7 shows the 2001-2003 distribution of crashes according to the time of occurrence. Figure 3-6 shows log truck crashes in comparison to all-vehicle crashes in the U.P. The pattern of log truck crashes with respect to time show some similarities to all vehicle crashes during the period from midnight to 5:00 PM (early morning and business hours). However, the two trends to not match well for periods after 6:00 PM, where the all-vehicle crash set continues to increase and the log truck crash set drops off to almost no crashes. This mismatch in the evening hours is due to the fact that the majority of log truck activity is during normal business hours, while the all-drivers data set shows the results of after work trips made during evening hours.

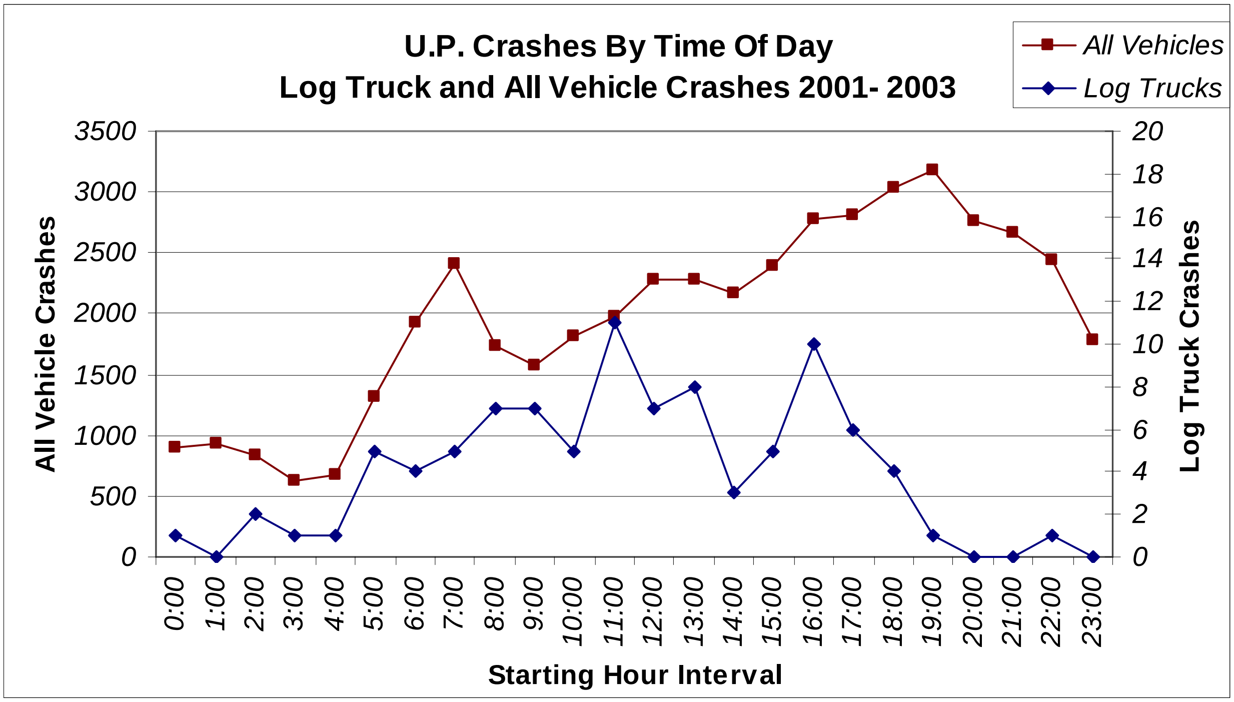


Figure 3-6. U.P. Log Truck and Vehicle Crashes by Time of Day

Figure 3-7 shows log truck crashes in comparison to truck and bus crashes in the U.P. There is a strong fit between these two sets of data, demonstrating that the majority of crashes occur during typical working hours.

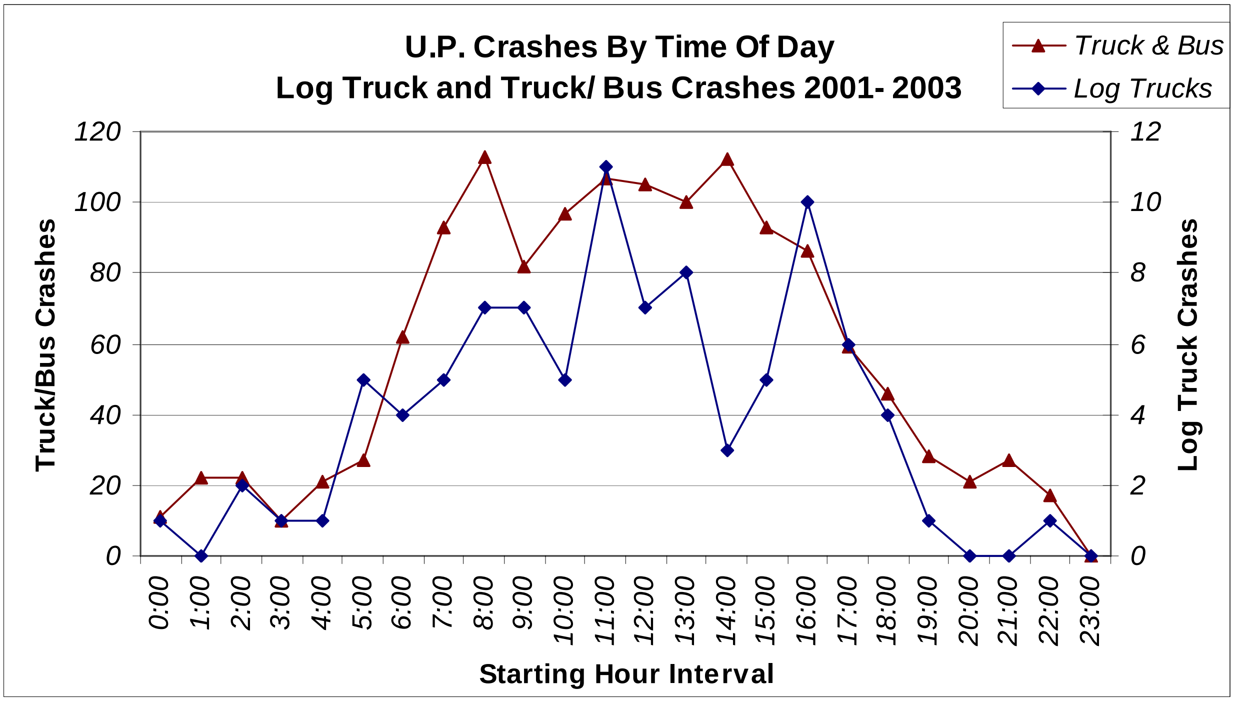


Figure 3-7. U.P. Log Truck and Truck/Bus Crashes by Time of Day

Crashes Involving a Log Truck in the U.P. by Day of Week

Figure 3-8 and Figure 3-9 shows the three year total (2001-2003) of crashes as they relate to time of day for log trucks, as well as the truck/bus, and all-vehicle data sets. The log truck data shows a moderate correlation to the all-data set, with some minor differences in pattern (Sundays for example). The log truck data set strongly correlates to the truck/bus data set showing an almost identical pattern of crash occurrence with respect to day of the week.

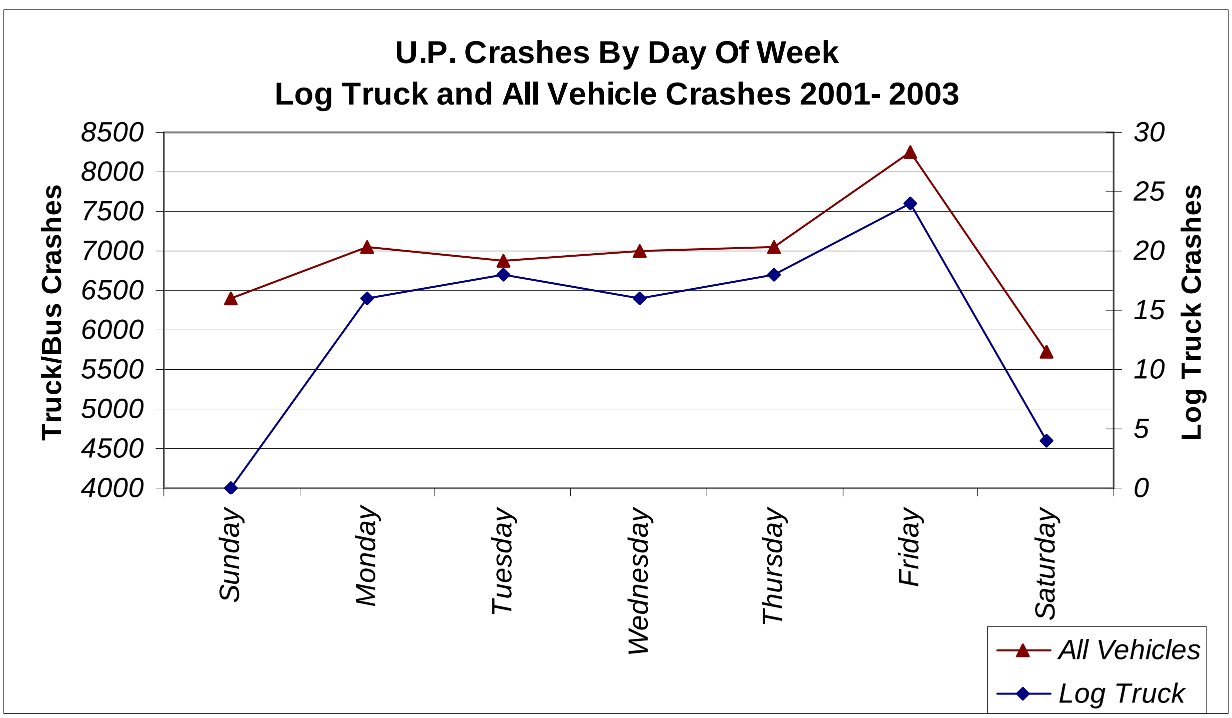


Figure 3-8. U.P. Log Truck and Vehicle Crashes by Day of the Week

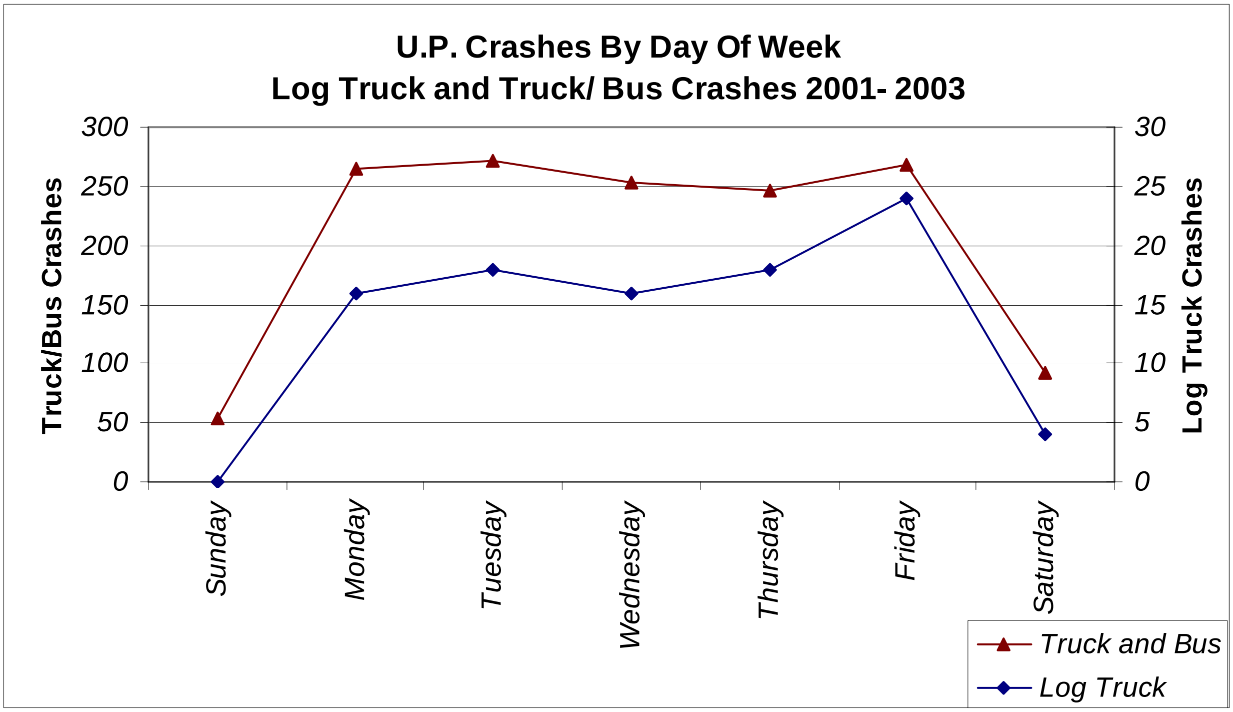


Figure 3-9. U.P. Log Truck and Truck/Bus Crashes by Day of the Week

Crashes Involving a Log Truck in the U.P. by Weather Conditions

Figure 3-10 shows the weather related distribution of log truck crashes, all-vehicle crashes in the U.P., and truck/bus crashes in the U.P. The patterns for all three data sets are generally the same, with about 50% of the crashes occurring when the weather conditions were classified as clear, 27% of the crashes occurring when the conditions were cloudy, 11%, to 15% in snow and blowing snow, and 4% to 6% of the crashes occurring when it was raining. This indicates that the log truck data set is similar, with respect to weather conditions at the time of occurrence, as the all-crash data set or the truck/bus data set.

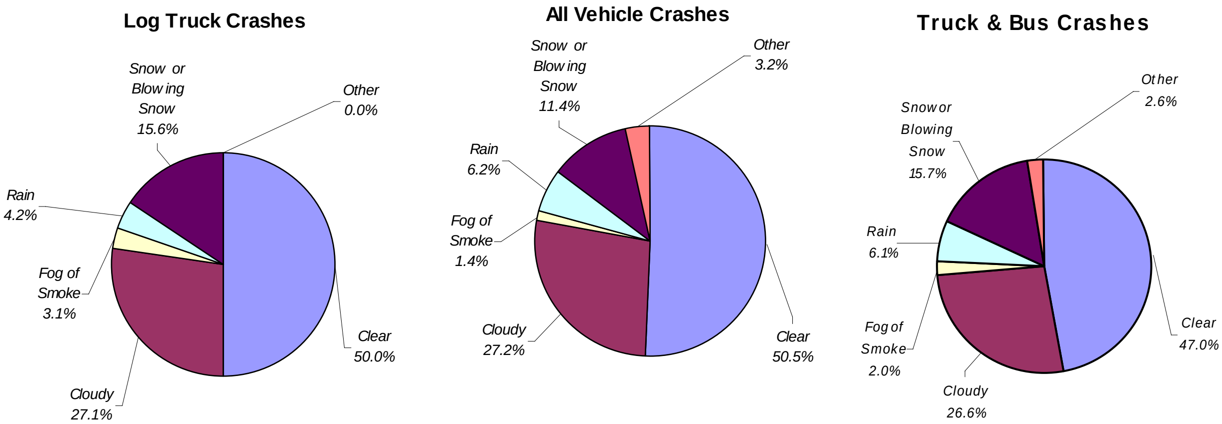


Figure 3-10. U.P. Crashes by Weather Condition

Crashes Involving a Log Truck in the U.P. by County

Figure 3-11, Figure 3-12 and Figure 3-13 shows the total distribution of crashes within each U.P. county for the three-year period (2001 -2003) for log truck crashes, truck/bus crashes, and all-vehicle crashes respectively. Comparisons between the three figures show that there is a very strong relative similarity between the three data sets from the perspective of crash occurrence by county. The only significant difference between the pattern of log truck crash occurrence and the occurrence for all-vehicle crashes and truck/bus crashes is observed in Dickinson County.

Dickinson County ranked first of all U.P. counties in terms of the highest number of log truck crashes. However, when looking at total crash numbers and truck/bus crash numbers it ranks fourth. The over representation of log truck crashes in Dickinson County is most likely attributed to the fact that the county is a major destination for log truck activity with two major mills—one in Quinnesec and the other in Sagola.

Two other significant differences are apparent in Baraga County and Chippewa County. Baraga County appears to be over represented in log truck crashes, since it ranks near the bottom for number of truck/bus crashes as well as total crashes, but ranks second in terms of log truck crashes. This could be due to the fact that state highways in Baraga County (M-28, M-38, US-41) act as a funnel for the log trucks coming from counties to the west and north. This trend is reversed for Chippewa County, which appears to be under represented in terms of log truck crashes with respect to total-crashes and truck/bus crashes. This could be due to the fact that Chippewa County does not have any log truck destinations and is not a large timber producer compared when with other U.P. counties. Without a measure of exposure from detailed logging truck traffic counts for each county, it is difficult to discern the exact reason for these deviations from the bulk traffic patterns.

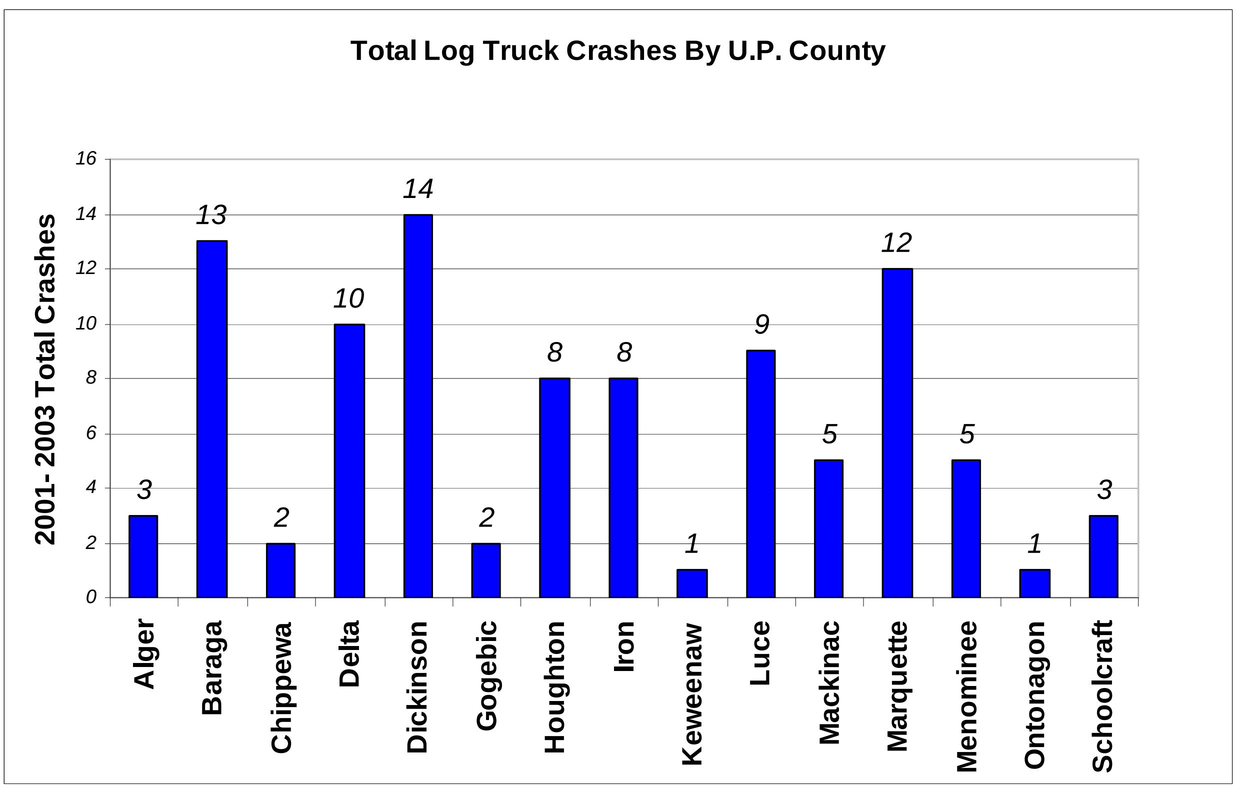


Figure 3-11. Total Log Truck Crashes by U.P. County

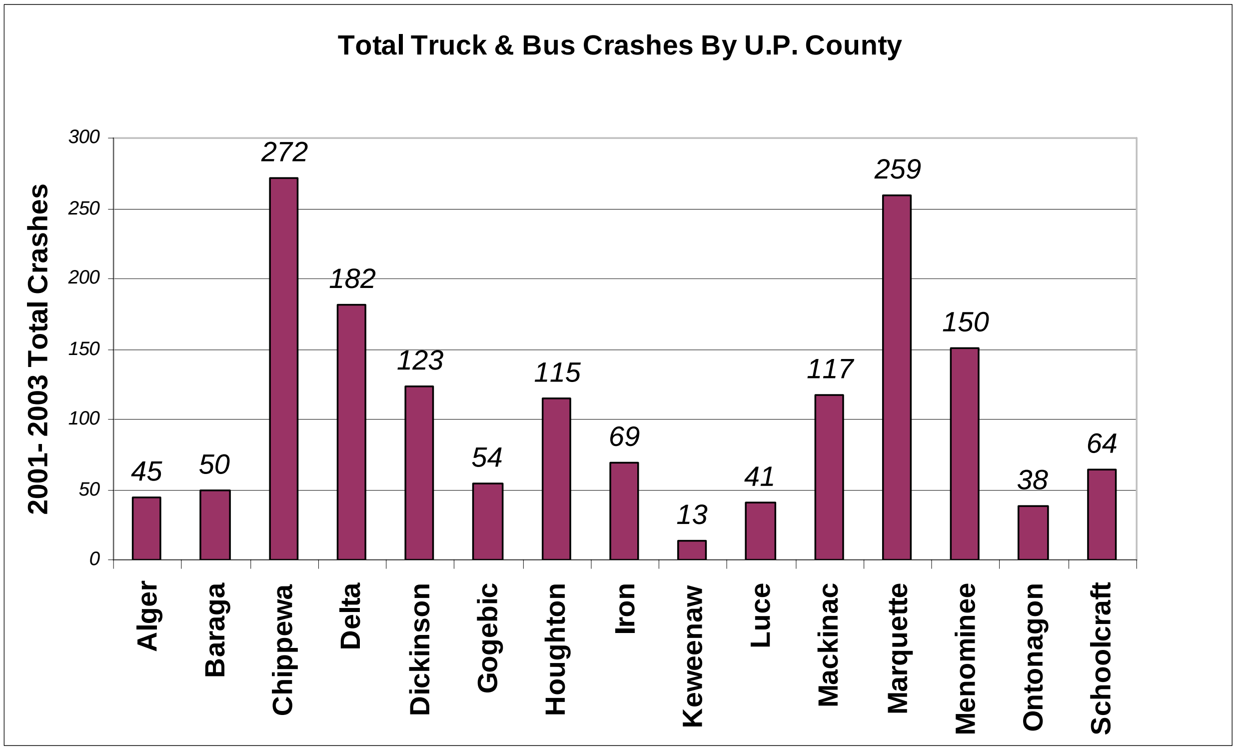


Figure 3-12. Total Truck/Bus Crashes by U.P. County

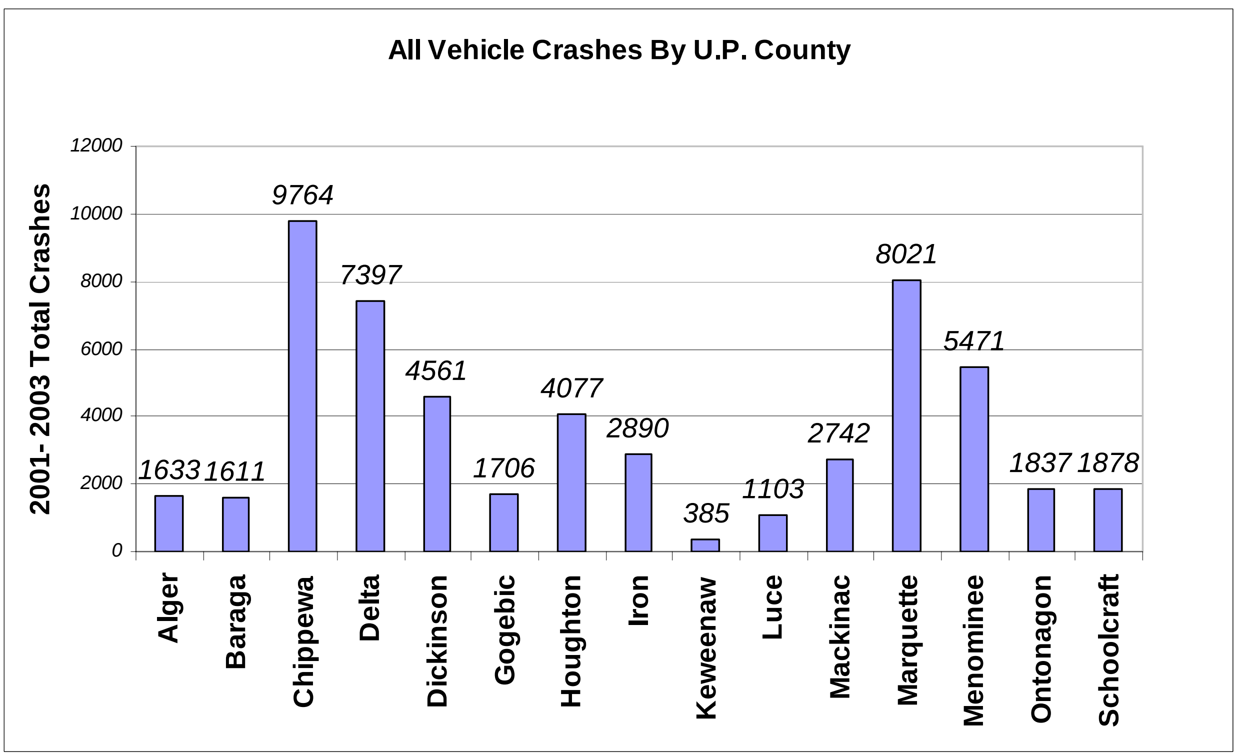


Figure 3-13. All Vehicle Crashes by U.P. County

Crashes Involving a Log Truck in the U.P. by Severity

During the three-year period (2001-2003) there were 3 fatal crashes, 3 crashes that resulted in incapacitating injuries, 6 crashes that resulted in non-capacitating injuries and 11 crashes that resulted in possible injuries. Figure 3-14, Figure 3-15 and Figure 3-16 show the percentage breakdown for crash severity for the log truck data set, the all-crashes data set, and the truck/bus data set. The three data sets are relatively similar as far as their percentage of fatality, injury, and property damage only crashes, with log trucks having a slightly higher percentage of fatalities and injuries than the other two data sets. This slightly elevated increase in percentage of injury and fatality crashes appears to be intuitive since log trucks are among the largest and heaviest vehicles on the road. It should be noted however, that due to the extremely low numbers of crashes involved in the log truck data set, the removal or addition of only one fatal crash would make a significant difference in this assessment (1 crash is equal to 1.04% of the log truck data set and 33% of the fatal log truck crash set).

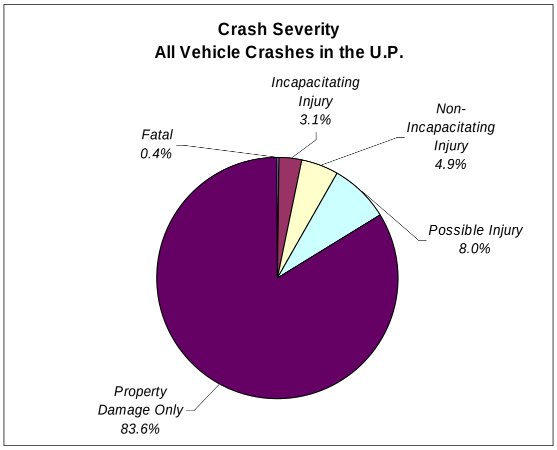


Figure 3-14. U.P. All Vehicle Crash Severity

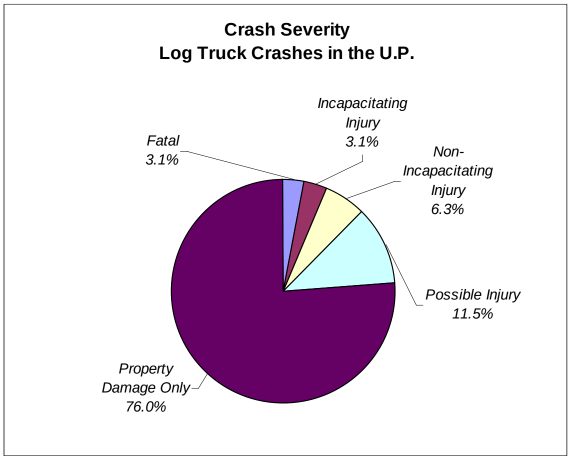


Figure 3-15. U.P. Log Truck Crash Severity

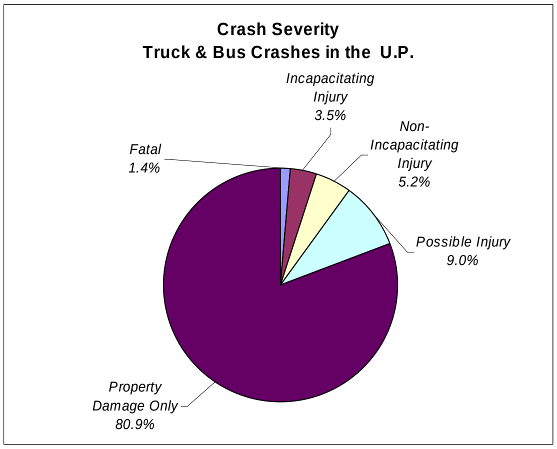


Figure 3-16. U.P. Truck/Bus Crash Severity

Crashes Involving a Log Truck in the U.P. by Fault

In some cases, the police officer investigating the crash made an assessment of fault or blame for the crash. Of the 96 log truck crashes, 62 involved two or more vehicles. Fault was assigned to the driver of the log truck 36.1% of the time, while fault was assigned to the other driver 47.5% of the time. No fault was assigned for 16.4% of the crashes involving two vehicles. In the 34 cases involving only a log truck, fault was assigned to the driver of the log truck 37.1% while no fault was assigned 62.9% of the time.

Of the three fatal log truck crashes in this data set, all were the result of passenger vehicles either crossing the center line (2 incidents) and striking a log truck head on, or disregarding right of way at an intersection and pulling out in front of a log truck that had the right of way. In all three fatal crashes, fault was assigned to the other driver, and no citations were issued to the drivers of the log trucks.

Of the three incapacitating injury crashes, two involved a log truck and another vehicle, and one involved just a log truck. In the first crash involving two vehicles, the log truck driver was assigned fault for momentarily loosing control of his trailer during icy road conditions when the back of his pup trailer veered into the oncoming lane of traffic and struck a vehicle. In the second crash involving two vehicles, the other driver was assigned fault for striking the rear end of a log truck while driving in the same direction. The third incapacitating injury crash involved a log truck driver who left the road and injured himself during the crash.

Estimated Crash Rates For Log Trucks in the U.P.

Crash rates per vehicle mile traveled are calculated for the log truck fleet based on the estimates of the number of vehicles operating within the Upper Peninsula and based on an estimate of annual vehicle miles traveled over the three year period of the study (2001-2003). Crash rates per vehicle mile traveled are used to give a measure of relative risk when comparing one condition to another, which in this case is comparing the rate of crashes for log trucks to that of all the traffic in the U.P., all the traffic in the state of Michigan, and all heavy truck traffic nationally.

The total number of log trucks and average vehicle miles traveled per truck used in the calculation are conservatively low. This approach provides a crash rate that can be viewed as the worst case, highest rate calculation. The log truck crash rates in the U.P. have been developed twice, one for the higher estimate number of trucks and one for the lower estimate number of trucks. A conservative number of 920 trucks statewide, is the number identified by insurance companies in Task 2 Inventory. The percentage of log trucks in the U.P. per the physical inventory in Task 2 Inventory was 80%. To remain conservative, that 80% (736 trucks) is used as the maximum number and 50% (460) is used as the minimum. Note the 50% creates the worst case calculation.

Data for vehicle miles traveled for a specific vehicle, such as log trucks, does not exist. The researchers calculated this number from three different sources. The first determination for the average number of miles traveled by a single log truck was an informal survey conducted with over 40 operators during safety inspections at the L'Anse and Escanaba pulp mills. The drivers indicated that on average, they travel between 60,000 and 100,000 miles per year, deliver 2 loads per day, and deliver 400 loads per year.

To verify the figures given in the operator survey, information from the resource manager at the Quinnesec Mill indicated that the company draws timber from an average distance of 80 miles from the mill. The operator survey responses of 400 loads per year were applied against Quinnesec mileage. The result is 64,000 miles per year, per truck.

160 miles/load (to and from the mill) X 400 loads / year = 64,000 miles per year, per truck.

A third method of estimating log truck vehicle miles traveled was calculated based on average possible travel in an average work day. For this calculation is was assumed that a driver would haul two loads a day, haul 400 loads a year, work an average of 9 hours per day, and spend 2 hours of the work day dedicated to loading and unloading. It was also assumed that drivers would maintain a 45 MPH “average” trip speed. This results in 63,000 miles per year, per truck.

400 loads/year/2 trips per day = 200 days operation per year

200 days/year X 7 hr/day driving X 45 MPH = 63,000 miles per year, per truck.

To remain conservative in the estimate of vehicle miles traveled, 80% of the lowest of the three estimates is used, which results in 48,000 miles per year. Again, using the lowest number of miles per year creates the worst case calculation.

60,000 X 0.80 = 48,000 miles per year.

The crash rates for "all vehicles in the U.P.", and "all vehicles in Michigan", are based on vehicle miles traveled information received from MDOT's Traffic and Safety Support Area. Comparative data for all heavy trucks in the United States was taken from the FHWA's Motor Carrier Division report titled, *2003 Large Truck Crash Facts*. A comparison of the log truck crash rates and the other three rates are shown in Figure 3-17. Figure 3-18 shows injury rates calculated for the same data sets. Figure 3-19 shows fatal and incapacitating injury crash rates for the same data sets.

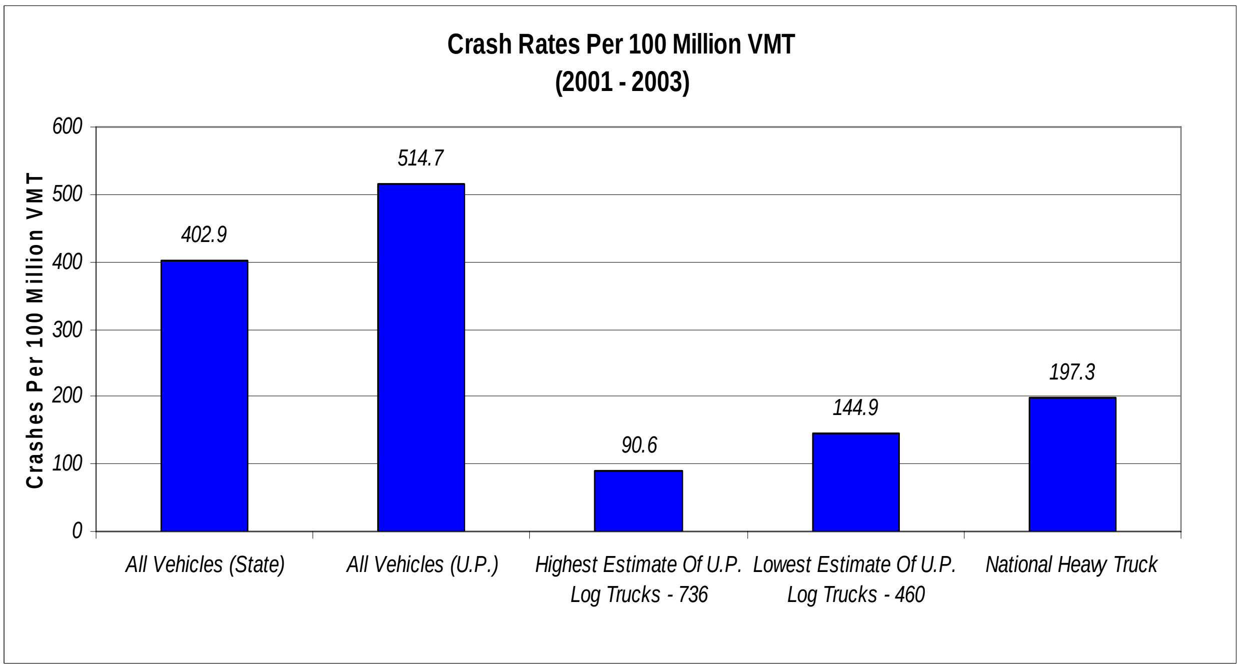


Figure 3-17. Crash Rates per 100 Million VMT

The crash rates shown in Figure 3-17 and Figure 3-18 are significantly lower for log trucks than all three of the comparative data sets. This is true even when using the extremely conservative figures for estimated vehicle miles traveled for log trucks, which produces the highest rate. The calculated severe crash and fatality rates shown in Figure 3-19 are also below the U.P. all-vehicle average and the all-state all-vehicle average. (The crash rate for heavy trucks in the U.S. is not included in Figure 3-19 due to the state-by-state differences in reporting injury severity.) Figure 3-17 indicates that log trucks actually pose less of a crash risk per vehicle mile traveled than all traffic in the U.P., all traffic in Michigan and heavy truck traffic nationally. Figure 3-19 indicates that log trucks pose less of a severe crash risk per vehicle mile traveled than all traffic in the U.P., and equal to or slightly less than all traffic in Michigan.

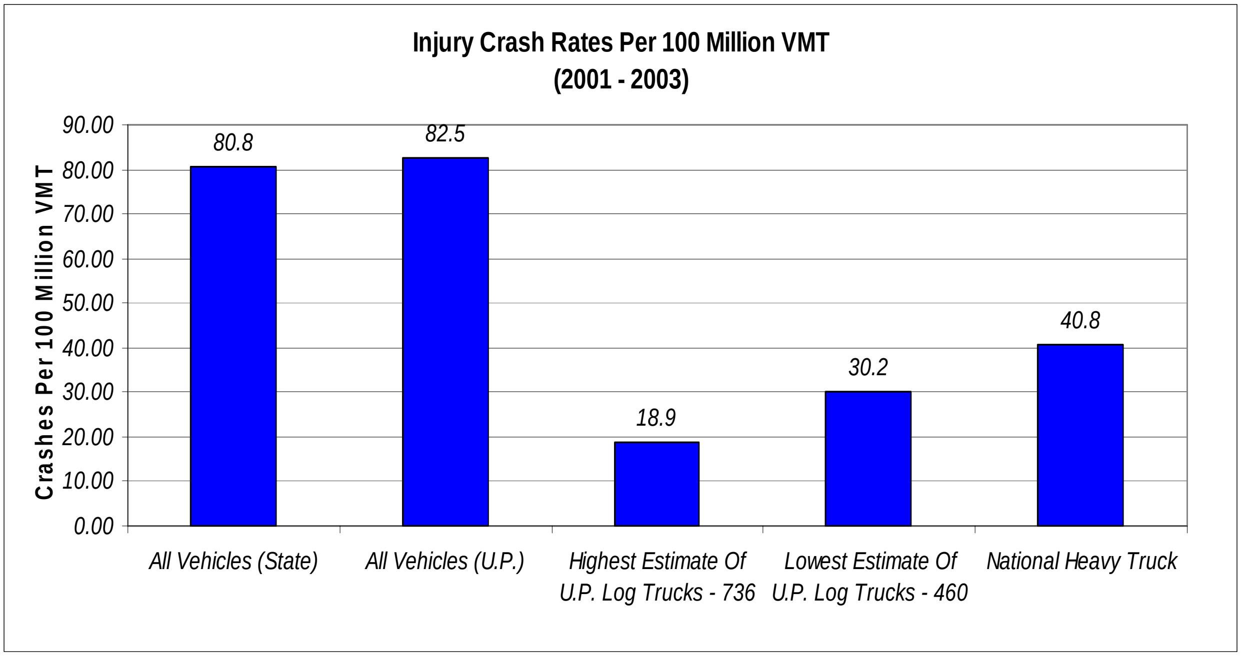


Figure 3-18. Injury Crash Rates per 100 Million VMT

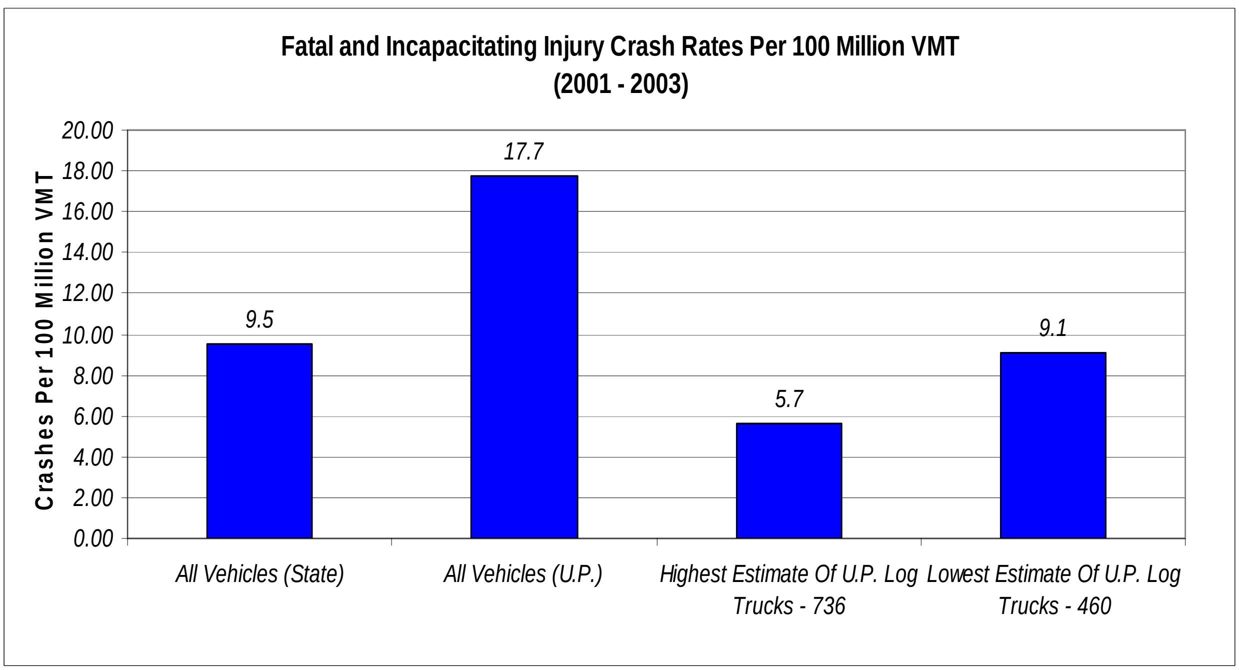


Figure 3-19. Fatal and Incapacitating Injury Crash Rates per 100 Million VMT

Care must be taken when evaluating the incapacitating injury and fatality results for log trucks because the population of these two crash types consists of only 6 crashes (3 fatal and 3 incapacitating injuries). These events are rather infrequent in nature and the addition or subtraction of only one or two crashes due to natural variability of occurrences over time can significantly influence the conclusions drawn by the data.

Crash location

Of the 96 U.P. log truck crashes, 83 can be physically located to a road segment, 13 cannot be located. Of the located crashes, 56% are within 150 feet of an intersection. This is similar to all U.P. truck/bus crashes, which have 50.6% of their crashes located at or near an intersection. The majority (69%) of U.P. log truck crashes occurred on a state highway, compared to 61% of the truck/bus crashes in the U.P. that occurred on a state highway. Per the crash data, no patterns were found with respect to specific location, section of road, or road geometric characteristics. Figure 3-20 shows the locations of the mapped log truck crashes.

Conclusions

In the analysis of three years of U.P. crash data (2001, 2002, and 2003) there were a total of 96 crashes that involved a log truck. This is an average of 32 crashes per year and represents 0.19% of all crashes in the U.P. and 6.6% of all truck and bus crashes in the U.P. There were three fatalities and three incapacitating injuries involving log trucks during the analysis period. The other driver was found at fault in all three fatal crashes.

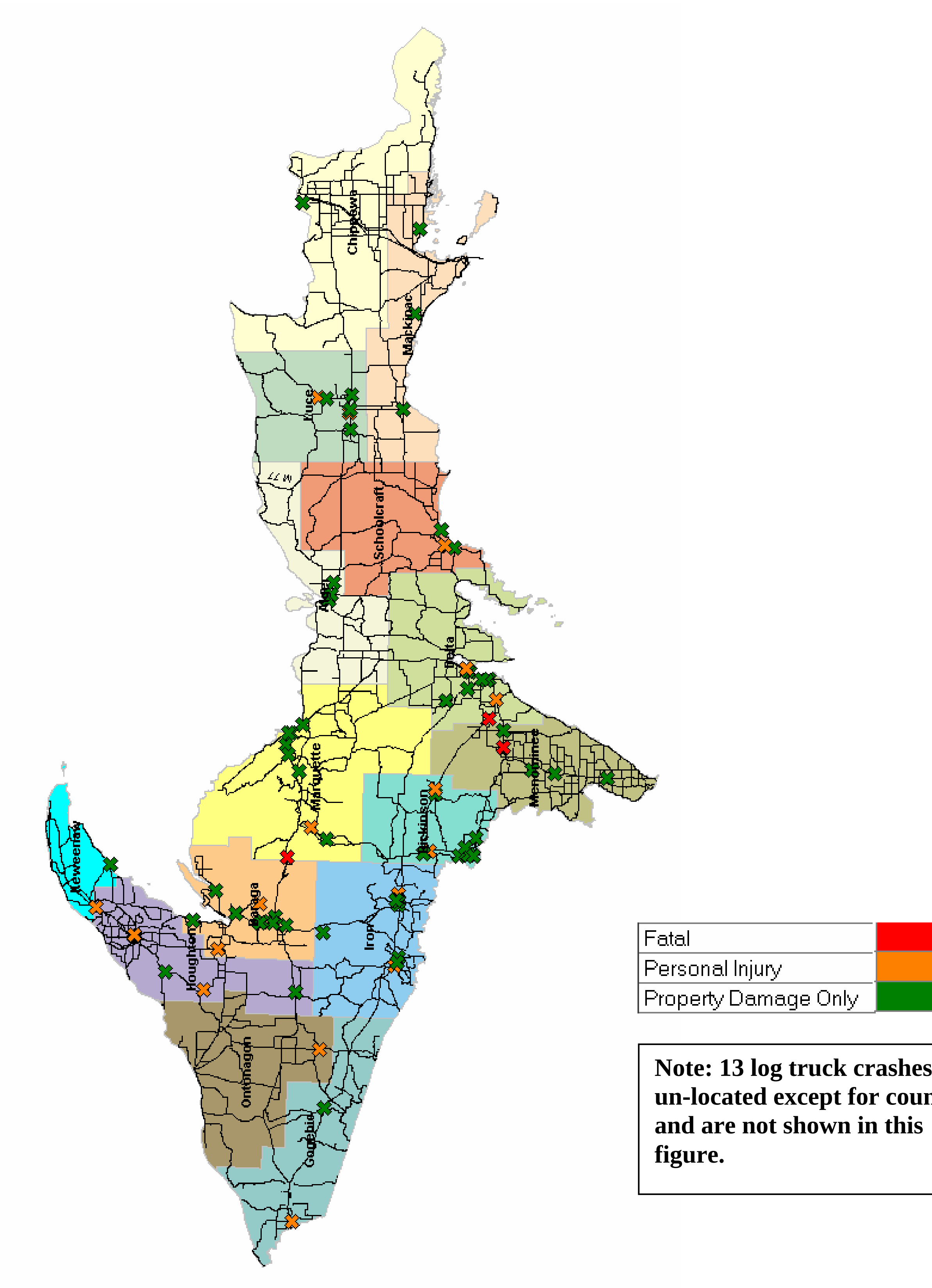
Comparisons between the crash patterns of log truck crashes, all U.P., and all U.P. truck/bus crashes during the same period, indicate that there is no significant differences in time of day, day of week, or month, than other truck or bus traffic that would indicate a safety concern.

It was discovered that the distribution of log truck crashes occurring within U.P. counties strongly follows the all-vehicle crash pattern and the truck/bus crash pattern within those counties. The exception was in Dickinson County where the number of log truck crashes was over represented with respect to the other crash patterns. This over representation is no doubt due to the heavy log truck traffic heading to Dickinson County’s two major pulp mills. Baraga County was also over represented in terms of log truck crashes when compared to both the “all vehicles” crash set and the truck/bus crash set. The inconsistency in Baraga could be due to the fact that the state highways through Baraga, M-28, M-38, US 41, act as a funnel between counties to the west and north.

The data indicates that log truck crashes are similar to the two comparative data sets with respect to weather conditions during the time of occurrence.

About 64% of the log truck crashes involved another vehicle. This is very similar to the peer group of all truck/bus traffic. In crashes involving another vehicle in which the investigating police office made an assessment of fault or blame, the log truck was assigned fault less than the driver of the other vehicle.

In the data sets studied, the distribution of log truck crashes resulting in property damage only, injury and fatality were only slightly different than the distribution of crash severity for U.P. truck/bus crashes and all of the U.P. crashes. There appears to be a slightly higher incident of fatality or injury in log truck crashes when compared to truck/bus crashes in the U.P. Intuitively this makes sense because the truck/bus data sets include vehicles which weigh as little as 10,000 pounds and the all-vehicles set includes passenger vehicles weighing as little as 3,000 to 4,000 pounds. It also should be noted that the fatality and serious injury breakdown of log truck crashes is based on only 6 crashes, so a change in one to two crashes would significantly impact the results.



Note: 13 log truck crashes are un-located except for county and are not shown in this figure.

Figure 3-20. Location of Mapped Log Truck Crashes and Severity

Even when using extremely conservative estimates of the number of log trucks and the number of vehicle miles traveled for log trucks, the total crash rates (number of crashes per 100 Million VMT) and injury crash rates (number of injury and possible injury crashes per 100 Million VMT) for log trucks were significantly lower than crash rates calculated for all U.P. traffic, for all Michigan traffic and for heavy truck traffic in the U.S. This indicates that log trucks generally pose less of a crash risk and injury risk per vehicle mile traveled than those other three categories. Fatality and incapacitating injury rates per vehicle mile traveled were also significantly lower than the rate for all U.P. traffic and equal to or less than the rate for all Michigan traffic.

Per the crash data, no patterns were found with respect to specific location, section of road, or road geometric characteristics.

One of the most significant challenges with studying log truck crashes in Michigan is the fact that there is no method for identifying a log truck crash from other heavy truck crashes other than manually sorting UD-10 Forms. This poses a significant burden given that there are just under 400,000 crashes occur in Michigan each year, of which approximately 17,000 are heavy truck/bus crashes. Likewise the information currently collected on the UD-10 Supplemental Heavy Truck data form does not provide the necessary information required to evaluate the spill and crash risk of different log truck configurations.

If continued study of log truck crashes is a concern to the policy makers, consideration should be given to revision of the UD-10 Heavy Truck Supplemental Form. Revision at a minimum should include the addition of a field to specifically identify log trucks from other heavy trucks and could include recording physical characteristics of the log truck.

TASK 4 – LOG TRUCK SPILLS ANALYSIS

Discussion

A review of log spills was made using information provided by the Michigan State Police. Records show that over a seven-year period, 1998-2004, 100 incidents were reported in which logs spilled or fell off of a log truck in the Upper Peninsula (U.P.). These reports were completed in response to a reported spill or observations made by an officer who came across an incident. In most cases, a formal UD-10 crash report was not completed.

There were enough incidents in the U.P. that Dickinson County mandated the use of automatic tensioners on all log trailers using county roads and at least one insurance company requires the use of automatic tensioners on crosswise loaded trailers.

Spill Factors

There are several factors that contribute to more spills in the U.P. vs the L.P. First and probably the most significant factor is the truck volume. The quantity of timber hauled by a truck in the U.P. is greater than the L.P., especially the crosswise loaded volume. The three largest pulpwood mills in the U.P. receive over 79,000 truckloads of pulpwood per year. The Gwinn mill, which produces eight foot length lumber, receives the majority of its 20,000 incoming truckloads as crosswise loaded. In addition to the mill loads, there are pulpwood loads that head to satellite yards and railroad sidings for eventual delivery to mills in Wisconsin.

The second contributing factor to spills in the U.P. is the weather. The longer winters in the U.P. mean many months of loading and transporting frozen, icy, and snow covered logs. The securement of crosswise loaded logs relies on the tie-down to create a downward force. This downward force, when combined with the log-to-log friction, generates a lateral force. Snow and ice between the logs decreases the log-to-log friction, thereby reducing the lateral force that is needed to keep the logs in place.

A third contributing factor in the greater number of spills in the U.P. is the species and type of wood being hauled. Poplar is one of the most common pulpwood species. The bark on a poplar log is smooth compared to many other species. In the spring when the sap begins to flow, the bark peels off easily, creating slippery logs, thereby reducing the log-to-log friction.

Figure 4-1. Log spill in Iron Mountain

Figure 4-2. Log spill in Houghton

Results

The records show an average of 14 spills per year for the seven years. However, the spill rate dropped to an average of 10 log spills the last three years. It has been over five years since a load loss from a logging truck has resulted in an injury or fatality. Fortunately, no one was injured in any of the recent log truck spills. However everyone in the timber industry is well aware that any of these incidents could have had a fatality.

Table 4-1. Log Spill Incidents

1998	20
1999	16
2000	18
2001	16
2002	11
2003	9
2004	10
Total	**100**

Telephone Survey

A telephone survey was conducted in an effort to collect additional information on the spills. Because of the sensitive nature of log spill incidents, many of the individuals involved were hesitant to comment.

Of the 100 log spill reports, only 32 drivers or companies could be identified. A large number of the spill reports were of logs on the road or in the ditch and could not be traced to the source. Of the 32 identified spills, 15 contacts were made – 12 completed the survey and three declined comment. The other 17 drivers could not be reached following several attempts.

Survey Questions and Results

1. Could you describe the spill incident?
   - loss of a few logs 1
   - lost more than half the load 10
   - trailer rolled 1
2. What was the vehicle configuration?
   - 7 + 4 (7 axle truck and 4 axle trailer) 5
   - 6 + 5 (6 axle truck and 5 axle trailer) 6
   - 6S + 5 (6 axle truck with 9 ft. spread) 0
   - other 1
3. What type of suspension system were you running?
   - steel springs 5
   - air ride 7
4. What type of securement was used?
   - chains 12
   - straps 0
5. What type of tensioners were used?
   - air binder 11
     - air bag 8
     - air cylinder 3
   - conventional chain binder...1

6. In your opinion what were the contributing factors* to the load loss?
   (* more than one factor could be identified)

   - type of load (slippery or icy logs, crooked logs)...............5
   - road conditions (rough road, sharp curve, weather)..........6
   - loss of securement 0
   - mechanical failure (tire blowout, spring failure)...............2
   - other..2

Comments from the survey

In addition to the questions, the drivers provided additional comments on the incident.

Driver A – Roads were perfect, the logs were freshly cut and icy/slippery, I drove around the corner too fast.

Driver B – Very slick roads, I was driving downhill and lost control of pup. The use of enclosed crib is the best way to go.

Driver C – I was driving downhill and lost control of the pup.

Driver D – Swerved to avoid a head-on collision. The pup slid to the right, following a steep shoulder slope. The truck regained ground when the pup snapped and ejected the logs. It wouldn't have mattered how the logs were loaded.

Driver E – Clear dry day, I was driving uphill when a woman talking on a cellphone drove her car over centerline. I swerved the truck to miss her, causing the pup trailer to tip over.

Driver F – The roads were icy, I had stopped at a red light and was traveling 5mph around a corner when a spring broke on the trailer. The trailer slid over and snapped the hitch. The air binders worked great.

Driver G – A car pulled in front of him, he slammed on brakes and directed vehicle towards the ditch so he didn't run into anyone. He believes that if the truck wasn't cribbed that people would have been in peril.

Driver H – Driving downhill when he hit black ice and lost control of the vehicle. All the logs flew off truck. After departure of the logs, he regained control of the truck. No chains broke.

Driver I – Intersection of US 141 & US 2 is a road that has been known to many truckers as having a terrible unsafe lean. Two sets of stop and go signs/signals.

Driver J – The roads were miserable and icy. It had rained on the fresh-cut wood the night before, so wood froze while loading. The wood was stacked and slash-cut, it was a good load with no crooked logs. He even flipped the wood to make even. The vehicle went into the ditch at 6mph. He put the axles down, but it didn't make a difference. Driver would like all log trucks to be cribs and longer, also have the logs cut to 20 feet instead of 8 feet.

Driver K – Accident happened while driving on a sharp 90 degree turn in a road detour, road had a drop from the surface to subsurface of 8 inches. Large slope on road caused vehicle to lean right, causing a major shift in weight to occur. Chain over wood became loose with large movement of force. This driver would like to see legislation for hauling wood lengthwise with longer rigs and 3-tier stacking on a pup.

Driver L – Ice storm the previous night. Chains loosened when ice melted on wood. The wood left the truck from the middle. Spill happened at an intersection with an inclined grade. Chains did not break, just loosened.

Conclusions

Limited success was achieved in attempts to identify and contact log truck drivers who were involved in log spill incidents. Of the 100 reported incidents received by the Michigan State Police, only 32 had sufficient information to identify a company or an individual. This is due to the fact that in many of the log spill incidents reported, officers would arrive on the scene only to find logs on the side of the road. In some cases the officers would respond to a reported log spill to find the logs had been removed and no information was available about the truck.

Of the 32 records that contained company or individual names, 26 could be tracked to a valid phone number. Calls to these 26 individuals or companies that could be positively identified and which had current phone numbers resulted in phone contact with only 15 individuals. The remaining 11 individuals in this group did not return repeated phone calls. Of the 15 individuals that were contacted, 12 agreed to a phone interview and 3 refused to comment.

Because of the small sampling size of the total group (12 out of 100 possible), there is not enough data to allow conclusions to be drawn from the data. However, the information gained from the interviews may provide some general insight into the nature of the spill problem. Caution should be exercised when reviewing the comments from the phone interviews as they represent the opinions of only 12 drivers.

If further study of log spill incidents is a concern to policy makers, a better method for tracking log truck spill incidents is required. This could include incorporating spill incidents into the crash record by considering log load loss as a crash. This would require drivers to report load loss incidents and have a UD-10 form completed for each incident or face a failure to report an accident charge.

Likewise the information currently present on the UD-10 form's supplemental heavy truck data form does not provide all the necessary information which is required to evaluate the spill and crash risk of the different configurations of log trucks.

Consideration should be given to revision of the UD-10 heavy truck supplemental form. Revision to the heavy truck supplement should at a minimum include the addition of a field to specifically identify log truck crashes and spills from other heavy truck crashes. Revision of the UD-10 heavy truck supplemental could also include recording any physical characteristic of the log truck which would be the focus of further study. This would facilitate easy identification of log truck crashes and would greatly reduce the time needed to compile the data.

TASK 5 – BEST PRACTICES AND RECOMMENDATIONS

Automatic Tensioners

Most log settling happens as the vehicle, loaded with non-uniform pieces, travels out of the woods on a rough and twisting logging road. Any settling of the load drastically reduces the tension in the tie-downs, and settling of more than one inch results in no tension in a conventional over-center binder or screw ratchet binders. Auto tensioners evolved because of the need for a securement binder that would accommodate the settling of a load of logs.

Air binders became a practical solution because all large transport vehicles have an air supply for their air brakes. Mechanical, spring type auto-tensioners have been tried, but did not perform as well as the air powered binders. Hydraulic cylinders could be used as tensioners because log trucks have a hydraulic system for their loaders, but this would be a complex and costly method. For any load of logs where settling occurs, frequent inspection and readjustment of the securement system is required. Log truck drivers consider it standard practice to stop and readjust the securement system before entering a paved road.

Air Binder Types

Air binders provide an efficient method for maintaining chain tension as a load of logs settles. There are three main types of air binders currently in use:

- air bags - similar to those found on air bag suspensions and lift axle mechanisms
- air cylinders - similar to hydraulic cylinder but operated by air
- air chambers - same hardware that is used for air brakes

All three types of binders have proven to be effective. However, without any regulations on air binder design, less than desirable air binders have appeared.

Air Bags

The most common type of air binder is the air bag system. It is within this type that the greatest variety exists. Air bags, technically referred to as air spring actuators, range in size from 6 inches to over 36 inches in diameter and have useable stroke lengths from 4 to almost 14 inches. Some systems use dual air bags with an individual air bag for each chain. Other systems employ a single air bag to apply tension to two chains.

Unlike the air cylinder and air chamber systems that operate at full vehicle air pressure, the air bag systems require pressure regulators to prevent excessive pull forces. Air bags are normally rated for a maximum pressure of 100 psi, although high strength 175 psi units are available. At high pressure an air bag system can generate enough force to cause a chain to cut through a soft log or even cause a chain failure.

It is impossible to state the force and take-up range of an air bag system because there is such a variety of bag sizes and tension arm lengths. A 7.2 inch diameter single convolution air bag has a stroke of 4.3 inches, and at 80 psi, the force ranges from 1,140 to 1,870 pounds. A 9.9 inch diameter double convolution air bag has a stroke of 6.0 inches and the force ranges from 1,770 to 3,790 pounds. Depending on the regulated air pressure and the location of the air bag on the tension arm, desired force and stroke can be obtained through different designs. It should be noted that even though the desired force and stroke can be obtained, once the unit is in use, the force produced by an air bag decreases as the stroke increases.

The advantages of air bags over air cylinders or air brake chambers are:

- low cost
- good durability
- no maintenance or lubrication requirements
- no sliding seals to wear out
- capability to handle angular motion
- compact height, and
- a temperature capability from -35 to 135 F

Figure 5-1. Common air bag system of two convoluted bags

Figure 5-1 shows a common air bag system using two double convoluted air bags with each air bag providing tension to an individual chain. The dual chamber provides for a greater stroke, which minimizes the need for long arms to achieve sufficient take-up capability.

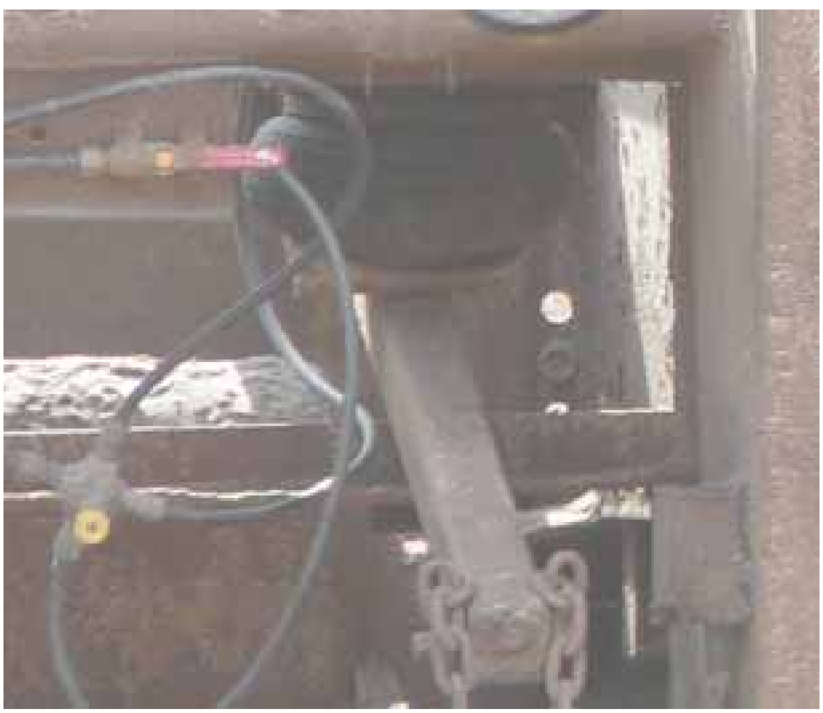


Figure 5-2. Single chamber air bag

Figure 5-2 shows another two bag system but with a single chamber. Note that the arm is longer and the air bag set further back in order to provide sufficient take-up capability.

Figure 5-3. Single large, double convoluted air bag

Figure 5-4. Large diameter, triple chamber air bag

The air bag system shown in Figure 5-3 employs a single large, double convoluted air bag. Due to the large diameter and dual chamber, the air bag can produce high force and long stroke even at the end of the tension arm. This single actuator system had an evener bar that rotated relative to the main arm and provided equal tension to both chains.

The large diameter, triple chamber air bag shown in Figure 5-4 could be considered over-kill due to both the force output and stroke capability. This also confirms two common user attitudes: bigger is better and making use of available components.

Air Cylinder

Another popular binder is the air cylinder. The air cylinder has been used as a log truck air binder since 1992. This cylinder has a three and one-half inch diameter bore, a one inch diameter rod, and an 18 inch long stroke. At an operating pressure of 120 psi (typical system pressure on air brake vehicles) this cylinder applies a 1060 pound force. The force is directly related to the air system pressure and remains constant regardless of the rod position. These cylinders are being installed on new vehicles and several hundred units have been sold for retrofit situations.

Figure 5-5. Air cylinder pair on a new truck

Figure 5-5 shows a pair of air cylinders on a new vehicle. Note that the tops of the cylinders were recessed below the trailer deck to prevent damage while loading or unloading logs. The tops of the cylinders were constrained with a rubber strap to allow movement so the cylinder can align with the chain orientation. A single actuator provides the same air pressure to each cylinder, but each cylinder acts independently for their stroke/take-up capability.

A common problem with earlier air cylinders was corrosion and pitting of the rod; which led to the rod sticking and/or seal leakage. Newer cylinders have specially hardened or coated rods to minimize corrosion. If air cylinders are not installed to allow movement, the rod can be bent and the cylinder ruined.

Air Chamber

The newest idea in auto tensioners involves using an air brake chamber. A type 30 or 36 chamber is used with a three inch stroke. Due to the limited travel of an air chamber rod, a lever linkage is employed to produce a 10 inch take-up stroke. The resulting pull force is said to be comparable to that of an air cylinder; however, resulting force would be dependent upon the lever arm ratios. These air binders are taking advantage of a component that has been certified for an air brake system, so they should be very reliable.

Tension Force Warning Devices

In the most ideal situation, the tension force in the tie-downs would be relayed to the driver with a separate indicator for each tie-down. If the driver knew that tension was changing, he could stop as soon as possible and make necessary adjustments. The indicator could be the actual numerical force value or a simple set of green/yellow/red lights. But determining the level of force in a tie-down cannot be done easily or cheaply. Using existing components, a force measuring system might be put together today for $10,000. With development, a wireless transmitter in a hermetically sealed load sensing unit may be able to be mass produced for $1,000 per tie-down.

Another possibility for warning devices would be through the use of limit switches. All automatic tensioners have the potential of stroking out – where all the take-up capability has been used up and the tie-down tension decreases to nothing. With a limit switch installed to trip when the take-up has reached 80% of its capacity, the driver would have time to find a safe place to stop and readjust his load. Many drivers with high take-up capability automatic tensioners say they have never come close to stroking out so limit switches are not needed. Units with less than 6-inch take-up could benefit from having a travel limit indicator. Although these switches are readily available today, the greatest problem with their implementation is wiring. For the limit indicator signal to be transmitted to the driver from the rear of a trailer another wire has to be strung, with a connector between the truck and the trailer. Long wires and poor connections are a constant source of reliability problems for log truck operators.

In air binder systems the air pressure could possibly be monitored and correlated to tie-down tension. Pressure gauges or pressure switches could be used as sensing elements. With both of these devices there is the wiring and connector issue of getting the signal up to the driver. Two issues that would have to be investigated are; stroking out and the single air bag systems. There is the possibility that when a system is stroked out, a pressure gauge would indicate high air pressure even though the tie-down tension may be low. In the single air bag system, the two tie-downs could each apply a different force but not indicate that there is a difference.

These warning devices, which could provide an indication of tie-down tension to the driver, would be helpful, but they are not a solution. Even with high tie-down tension there can be load securement problems. A poorly stacked load with a few high logs will cause the tie-down to bridge across the top of the load. The tie-down tension may be high, but if the load does not settle and trip the limit switch, the load is not actually secure. Under this scenario the warning devices may give the driver a false sense of security. Tie-down tension is only one part of the load loss issue. Other factors affecting load loss that are equally important are stacking, tree species, weather conditions, traveling speed and road conditions. It is not possible to develop a warning device that addresses concerns about all these factors.

Air Binder Recommendations

There are four criteria that determine the effectiveness of an air binder.

- stroke or take-up capability
- force
- air supply system
- attachment to the vehicle

Being able to apply up to 3,000 pounds of tension on each tie-down and being able to take-up 12 inches of load settlement would be an ultimate goal. Many systems are currently in use with far lower capabilities, but still appear to be effective.

Stroke or Take-up Capability

The take-up capability of air binders observed during the course of this study ranged from over 4 inches to over 18 inches. A take-up capability of 8 – 12 inches is desirable and sufficient. Short stroke (four to six inch) binders are considerably better than over-center or ratchet type binders that have no take-up capability, but a larger capacity is desirable. On the other extreme, the 18 inch stroke of many air cylinders is virtually never utilized on the road.

The load of logs will always have its greatest amount of settling immediately after loading and while traveling on rough and twisting logging roads. It is common practice for a trucker to check the securement system before entering a public or paved road. After the securement system is readjusted prior to entering the public road, any additional settling is minimal. The type of wood, distance to the mill, and road quality are factors that the driver will consider to determine if the binders should be checked again. Truckers with short stroke binders are more likely to stop and readjust. Drivers with the longer stroke binders almost never have to stop after the initial readjustment.

Force

The vast majority of log hauling vehicles use chains for their tie-downs. Michigan law requires chains with a Working Load Limit (WLL) of 4,700 pounds. At very high tension (greater than 3,000 pounds); the chains could cut through softer logs. The force generated by an air binder should create a tie-down tension of 1,000 – 3,000 pounds. Experience has shown that air cylinder systems with 1,000 pound capacity are adequate.

Forces greater than 3,000 pounds can be achieved with an over-center binder, but only if a "cheater bar" that extends the leverage is used. That force dwindles down to nothing if the load settles more than one inch. So, as mentioned in the stroke discussion, any air binder system is better than the traditional over-center or ratchet binders.

Air Supply Considerations

On a heavy vehicle, the primary purpose of the air system is to provide vehicle braking. All other air uses are secondary and must not degrade the brake system. Newer log truck/trailer combinations use air for numerous other purposes including air suspensions, lift axles, and air actuated clutches. When any air binder is added to a vehicle, two major concerns that require special attention are the compressor supply capability and reservoir capacity.

The air compressor must be able to recharge reservoirs as specified by federal regulations. There must also be sufficient air reservoirs to provide an air supply when the air compressor is off. Combination vehicles with 11 axles of air brakes, plus lift axles, require an engineered approach to compressor capability and reservoir capacity.

In order to protect the air brake system, a protection valve **must** be installed upstream of any air binder system. Often referred to as a "Williams" valve (most common manufacturer), the protection valve is a check valve that only provides air to the air binder system after the vehicle air pressure is greater than 75 psi. In the event of a vehicle line failure and resulting low air pressure, all air is dedicated to the brake system, but the air pressure in the air binders is not reduced. In the event of the failure of an air bag or an air line, a check valve prevents the vehicle brake system from being compromised.

Figure 5-6. "Williams" check valve installed between air reservoir and air binder system

Figure 5-6 shows a new "Williams" valve installed between the air reservoir and the air binder system. This valve costs less than $20, is readily available and necessary on any add-on to a vehicle's air brake system.

Acceptable Securement Methods

The tie-down system for securing a load is only as strong as its weakest link. Securement laws specify evaluation of the strength of all components in a tie-down. In Michigan, log hauling vehicles are required to have a tie-down system that has a Working Load Limit (WLL) of 4,700 pounds or 1/6th of the payload, whichever is greater.

Figure 5-7. Strap system used for load containment.

Chains, Cables and Straps

The load securement laws allow the use of chains, cables, or straps for securing logs. Chains are the predominant choice of tie-down, especially in the Upper Peninsula where a 5/16 inch grade 70 chain is the most common tie-down used. Straps are becoming more prevalent in Wisconsin and the Lower Peninsula. Cables are almost never used, probably because of the difficulty in storing them.

When questioned why straps were not popular in the U.P., several reasons were cited: not durable enough, too bulky, too difficult to wrap up and unwrap after getting wet and frozen, and not available in lengths long enough for crosswise loaded trucks and trailers. Yet one operator with a strap system claimed that it had been trouble-free for two years of crosswise hauling of pulpwood in the U.P.

The users of straps appreciate their low weight and the ease of tossing them across a load. Straps also have much better elongation than chains, which helps maintain tie-down tension even when air binders are not utilized.

Chains on the other hand have a proven track record. They are durable in the logging environment of dirt, rocks, ice, branch stubs and rough bark. At high tension, chains can bite into the wood for additional constraint. Regardless of how wet, dirty or oily; chains can easily be stored in a box. The only real disadvantage of chains is weight.

No conclusion can be made as to whether straps or chains are better for securing logs. Both are acceptable, providing they meet stated size and strength requirements and are in good condition. For securing logs, it is more important to maintain tension on the tie-downs, than the type of tie-down.

Vehicle Attachment

One of the greatest concerns with overall tie-down strength is the use of welded chains and components, especially to the arms of an air binder system. High strength chains and hooks become brittle and lose strength when welded. Weld repaired chains are not allowed by law; so chains or hooks welded to air binders as shown in Figures 5-8, 5-9 and 5-10 are all unacceptable.

Figure 5-8. Welded chains – NOT LEGAL

Figure 5-9. Welded Hooks – Unacceptable (unless specifically designed for welding)

Figure 5-10. Welded Clevises – Not acceptable

Figure 5-11. Welded loop. Acceptable type of attachment

The preferred methods of attaching chains to the arms of an air binder are loops or tabs and clevises. Figure 5-11 shows a loop securely welded to an arm, a chain can be run through the loop and hooked to itself.

Another acceptable method of attaching a tie-down to an air binder is through a welded on tab and a clevis as shown in Figure 5-12. The welded on tab provides not only a compatible weld material but also a large weld area for distributing the load. Utilizing a clevis on the tab insures that the tie-down tension loads are produced through a preferred engineering practice (double shear versus bending and shear).

Figure 5-12. Welded tab and clevis

Another method of attaching a chain to an air binder arm is with a bolt. This method can be acceptable if a high strength bolt is used, but is not highly recommended because the bolt can be subjected to bending instead of pure shear.

Figure 5-13. Less than ideal bolt attachment of chain to tension arm

Figure 5-14. Good solid attachment of one tension arm of a two arm system

The other area that needs attention when installing an air binder is the attachment to the vehicle frame. Figures 5-13 and 5-14 show two of the differences found in binder attachments. Figure 5-13 shows a less than ideal attachment of chains to the tension arm, while Figure 5-14 shows a properly sized and good attachment of the tensioner to the vehicle frame. Too many systems are mounted weakly. Too few bolts, undersized bolts, and poor welds could lead to the entire binder system being ripped off the frame in the event of a major load shift. Technically, the single air bag systems that operate a pair of tension arms should have an attachment with 9,400 pound load capability minimum.

Other Considerations

The installation of air cylinders should not result in bending loads being applied to the rod. The air cylinder can be flexibly mounted so as to allow angular motion, or the chain can be guided to insure an in-line pull.

Air bag systems should use stops for both directions as specified by the manufacturer. Repeated collapsing to minimum height and/or extending to maximum length shortens the life of the air bag. Manufacturer recommendations should be followed for useable stroke length. Attention must be paid to the maximum pressure rating on the air bag.

Comments

During this study, air binders were found to be used on the vast majority of trailers operating in the U.P. (industry representatives say upwards of 90%). This is due in part to Dickinson County mandating air binder use on all trailers passing through the county.

Interestingly, air binders are not common in either the Lower Peninsula or Wisconsin. The use of this seemingly great idea appears to be limited to large pup trailers in the U.P. If air binders are so good, why are they not being adopted by all log haulers? The prevailing attitude appears to be that air binders are good, but not necessary in all applications. In Wisconsin the loads are much smaller due to the weight and axle limits, also lengthwise loading in crib style trailers is becoming more common. A high percentage of L.P. hauling is smaller, lengthwise loaded, random length logs headed to sawmills, and there is much less crosswise hauling of pulpwood.

Automatic Tensioner Design Standard

An automatic tensioner system should meet the following minimum standards.

Take-up Capability

a. 6 inches of take-up capability should be the minimum for any automatic tensioner system.
b. 8-12 inches of take-up is desirable.
c. Use a mechanical stop to prevent an air bag from over-extending and failing.

Force at the Tie-down

a. A minimum of a 1,000 pound force should be constantly applied to each tie-down. Be aware that the force generated by an air bag decreases as the stroke increases.
b. Force at the tie-down should not exceed 3,000 pounds. Use a regulator to reduce the air pressure if needed.

Air supply system

a. A protection valve must be installed between the air binder system and supply reservoir, typically a "Williams" valve is used.
b. The air reservoir volume must maintain air pressure when the compressor is off.
c. The capacity of the air compressor must be able to recharge the original system and all additional reservoirs within the time specified by federal air brake regulations.

Binder Attachment to the Vehicle Frame

a. Air binders need to be firmly attached to the vehicle frame and capable of withstanding loads equal to or greater than the Working Load Limit of the tie-down, typically 4,700 pounds for each tie-down.
b. If two tie-downs are attached to a single air binder system, then the attachment to the vehicle frame must withstand two times the tie-down Working Load Limit.
c. Preferred methods of attaching chains to the arms of an air binder are with loops, tabs and clevises.
d. Never weld a chain to an air binder system.
e. Do not weld hooks or clevises to an air binder unless the parts are specifically designed to be welded.

Material Specifications

a. All load carrying portions of an air binder system must be capable of reacting to forces at least equal to the Working Load Limit of the tie-downs.

Fail-Safe

a. The Williams protection valve provides the fail-safe mechanism.

Crib Style Vehicles

A crib style log hauling vehicle is described as lengthwise loaded logs with lateral securement (bunks) and both a front and rear gate that would prevent longitudinal shifting of the logs. Figures 5-15 and 5-16 are examples of two crib style vehicles. Crib style trailers offer an improvement in log hauling safety. The crib style is being applied to trailers and some semi trailers, but no one seems to be pushing for the crib style trucks.

Figure 5-15. Michigan crib semi trailer hauling bunks of 8, 9, 10 and 12 foot saw logs

Crib trailers are the current trend in Wisconsin. Because of axle and weights limits, Wisconsin log haulers are almost always weight-limited before being volume-limited. Therefore there is no economic penalty for lengthwise loading. The real advantage of the crib style trailers in Wisconsin has been the changes in load securement requirements. The Federal Motor Carriers Safety Administration (FMCSA) has ruled that in many cases lengthwise loaded crib trailers require no securement. Securement is required only when the lengthwise bundles are of different heights or large gaps exist between the bundles. Wisconsin adopted these recommendations, Michigan has not. The elimination of any securement requirements for lengthwise loaded crib style trailers has resulted in a huge time savings. Cribs are also being promoted from the safety aspect, but interestingly, not just on-the-road safety, but the off-road safety as well (less time spent exposed to hazards in the woods).

Figure 5-16. Wisconsin crib with two bunks of pulp wood

For the log truck driver, the time spent in the woods is the most dangerous because of the surrounding equipment and conditions (skidders, dozers, fellers, chainsaws, mud, ice). The operator with a lengthwise loaded crib style rig pulls up to the site, loads up and leaves. The operator who is crosswise loading spends twice as much time in the woods. He has to stack his load more carefully, and then climb on top of his load to drape the chains across the load, the entire time being careful not to slip. If the cut-to-length processor did not accurately cut the log to length, the operator must get out a chainsaw and trim the extending log, often placing himself in a precarious position. He will also have to stop and check his binders a couple times en route, each time being exposed to traffic hazards.

Michigan truckers are not adopting the crib style at this time for two main reasons – load capacity and load securement. The load securement issue is simple – although FMCSA has ruled on crib trailer securement, Michigan law still requires two wrappers per bundle. (The FMCSA sets minimum requirements, but individual states may require stricter standards.) For Paul Bellmore's prototype 6-bunk crib style truck and trailer that was demonstrated a few years ago, 12 wrappers were required. The time required to attach and detach 12 wrappers, when a similar size crosswise loaded vehicle requires only four wrappers, was a huge deterrent to acceptance.

The main issue with crib style rigs in Michigan is the load capacity. Proponents of the Michigan cribs claimed that order to carry the same volume of lengthwise loaded logs as is currently legal for crosswise loaded logs, the overall combination vehicle length needed to be increased from 70 feet to 75 feet. Current combination vehicle lengths were frozen by an Act of Congress (Intermodal Surface Transportation Efficiency Act of 1991) so the State of Michigan does not have the authority to increase the length. Requests by Michigan at the federal level for an increase in overall length have been denied.

To carry the same volume of wood in a crib style rig, six lengthwise loaded bunks are required. While there currently are rigs operating in Michigan that are hauling six bunks of lengthwise loaded logs and meeting the existing overall vehicle length requirements, the need for the 75 foot length was for *similar* combination vehicles. Specifically a truck and trailer combination with a loader – the type of log hauling vehicle most commonly found in the U.P.

Figure 5-17 is a B-train, a tractor with two semi trailers, hauling six bunks of lengthwise loaded pulpwood (100-inch logs). A few B-trains also have a loader mounted on the rear of the lead trailer. These tractor and semi trailers can operate within existing vehicle length limits. These rigs are set up for lengthwise loading, but do not use cribs because of the extra tare weight and increased difficulty in loading and unloading.

Figure 5-17. B-Train with 6 bunks – Not a Crib style

Six bunks of lengthwise loaded pulpwood cannot be put on to a truck with a loader and trailer combination within the current 70 foot overall length constraint. Several log truck and trailer manufacturers were consulted and no one could provide a six bunk lengthwise loaded truck and trailer combination with a loader. The important fact here is that anyone considering lengthwise loading wants to be able to haul the same capacity and capabilities as currently utilized. A truck plus trailer and loader is necessary.

Figure 5-18. Michigan rig hauling random length saw logs lengthwise loaded

The truck and trailer combination is preferred in most U.P. log hauling operations because of its capacity, mobility and maneuverability. Capacity is simple to understand – the volume of logs. The current vehicles are right at the critical design point where the volume limit equals the weight limit – under average situations. But wood density varies tremendously. A load of cedar logs will always be volume limited before reaching weight limits. A load of hardwood often reaches a weight limit before the vehicle is filled to volume capacity. This differs significantly from Wisconsin, where weight limits are almost always reached before the available volume.

The main reasons for Michigan's truck and trailer combinations are maneuverability and mobility. Maneuverability refers to the ability to make tight turns on a winding forest road. A 53 foot semi trailer could never follow a 40 foot truck with 30 foot trailer through many of the U.P. logging roads. A more critical issue is mobility or traction. A large portion of the truck load is directly over the drive axles, and extra high loading can be obtained by lifting the non-drive axles on a truck. B-trains and semi trailers require a tractor to pull the majority of the load. Traction is such a critical issue in many of the U.P. logging sites that some drivers have recently gone to trucks with three drive axles instead of only two drive axles.

Although several 11 axle Michigan rig configurations exist, they all share the common traits of high capacity, good maneuverability and mobility, and a proven record. As it currently stands, no log hauler will give up the productivity of the current configuration just for the presumed safety benefits of lengthwise loading in crib style trailers.

Probably the most likely way cribs would be adopted by Michigan log haulers is if the insurance companies significantly raised the rates for crosswise hauling while recognizing the lower risk (and lower premiums) for lengthwise hauling.

Comments on the NMU Survey

In 2004 Northern Michigan University (NMU) Public Policy students, with support from the Governor's Office for the Upper Peninsula, conducted surveys at three U.P. spring logging conferences in Newberry, L'Anse, and Iron Mountain. Appendix 6 contains a survey summary.

First it is interesting to note that the number of participants that identified themselves as log truck drivers was just over 200 each year. This number is at the low end of the estimate of the number of log hauling trucks in the U.P.

Second, in reading the comments that accompanied the questionnaire, one comes away with the underlying tone that log hauling safety has much more to do with the driver than it does the equipment. Crib style vehicles or new securement methods will never eliminate log spills.

There was not wide spread agreement among the drivers that crib style hauling is a solution. Drivers point to years of experience with crosswise loaded trucking and millions of miles with relatively few incidents. Many drivers felt that the reduction in payload capacity due to the extra steel in a crib vehicle was a significant financial penalty.

Best Practices for Load Securement

After hauling millions of loads over the past decades, the timber industry has a clear understanding of acceptable methods for load securement. But after viewing hundreds of loads during the course of this study and seeing countless variations for load securement, it is obvious that there is still room for improvement.

Figure 5-19. Preferred load with slightly crowned load and chains in contact with as many logs as possible

The North American Load Securement regulations, Section 393.116(4), states: “Each log that is not held in place by contact with other logs or the stakes, bunks, or standards must be held in place by a tie-down.” For a tie-down to achieve contact with all logs on the top of the load, the load must be crowned. The configuration shown in Figure 5-19 provides the best possibility for load stability and insures that the tie-downs provide proper tension to the entire load.

Figure 5-20. Bridging results in the chains riding above the majority of the load

Bridging occurs when a chain touches a few logs and spans above most of the rest. Figure 5-20 shows an example of bridging. It is a result of poor stacking of the load and increases the potential for a crosswise loaded log to slide outwards.

Spacing

The newest *North American Load Securement* regulations regarding logs simply states that if two chains are used to secure crosswise logs, the chains should be at placed at 1/3 intervals. Assuming a maximum nine foot length log, the chains should be placed three feet from the ends – leaving three feet between chains. No scientific evidence was presented to back the 1/3 spacing requirement.

Figure 5-21. Spacing of approximately four feet with air cylinders

Figure 5-22. Chains with air cylinders spaced approximately at two feet

The load of pulpwood in Figure 5-21 was secured with chains and air cylinders. Note the approximate 1/3 spacing of the chains.

The load of saw logs in Figure 5-22 was also secured with chains and air cylinders. Note the narrow two foot spacing of the chains, violating the 1/3 rule.

Figure 5-22 also shows a common practice among log truck drivers. When loading logs, drivers will usually attempt to make the driver's side (closest to the road centerline) as flat and straight as possible. Longer logs generally hang out on the curb side. One reason for making the driver's side flat is to increase the driver's visibility of vehicles approaching from behind.

Chain Angle

The greatest chain tension force is obtained when the chain is in-line with the binder pulling direction. With the chain off to the side, the tension force is less and the chain also has the tendency to slide and create excessive slack.

The chain spacing on the top of the load in Figure 5-23 is desirable, but the narrow spacing of the air binders creates problems. The severe angle of the right side chain to the air binder could cause binding in the cylinder or potentially bend the rod.

Figure 5-23. The potential for chain slack and cylinder damage is increased with an angled chain

The load of crosswise loaded pulpwood shown in Figure 5-24 was being hauled on a B-train. Note how the chains go over the top of the load, around the rear posts, and secure to the side rub rails of the trailer. There is nothing illegal with this method, but it is not desirable or recommended. A better practice would be to bring the chains straight back and tie off at the push bumper.

Mixed Loads

A log truck is not making money unless it is loaded and moving. So drivers try to be as versatile as possible. One load may be crosswise loaded logs headed to a pulp mill and the return trip might be random length, lengthwise loaded logs for a saw mill. Then there are the times where in order to maximize the load capacity the driver will have some logs loaded crosswise and others loaded lengthwise. Lengthwise loaded trucks that are pulling crosswise loaded trailers are not uncommon and present no securement issues. The potential for problems arise when both crosswise and lengthwise loading is done on the same vehicle.

Figure 5-25 shows a 7+4 Michigan rig with mixed loading on both the truck and trailer. The crosswise logs are 8 foot and the lengthwise logs are 9 and 10 foot. Note the chain bridging at the rear of the truck. If the single row of crosswise logs on the top of the lengthwise logs had been moved to the rear, the bridging may have been avoided (but potentially the rear axle weight limits could be exceeded). One reason for loading in this manner is to reduce the number of tie-downs. As shown in the photo, two tie-downs were required on the truck's load and two tie-downs for the trailer. Without the single layer of crosswise logs on top, two tie-downs would have been required for each lengthwise loaded bundle, in addition to two tie-downs for the crosswise logs.

Figure 5-24. B-train hauling crosswise pulpwood with undesirable securement

Figure 5-25. An 11 axle combination with logs loaded crosswise and lengthwise

SUMMARY

Over 4,000,000 cords of timber are harvested in Michigan each year. This results in the transportation of over 250,000 loads of logs and about 23 million miles of loaded vehicle travel. Michigan log hauling vehicles are among the largest vehicles operating on a daily basis in the nation. The largest Michigan log truck trailer (pup) combinations are 9 feet wide and 13 feet high (when loaded). They are usually 70 feet long and can weigh a total of 164,000 pounds. The average truck often carries over 110,000 pounds of wood per load, and securement of that load while traveling on public roads has been and will continue to be a concern.

State & Federal Truck Size and Weight Issues

Long Combination Vehicles (LCVs) are normally considered a tractor with either two or three trailers. The Michigan log truck combination, consisting of a truck and trailer, also falls into this category. Michigan log truck combinations are currently limited to a maximum of 70 feet for the truck and trailer. Changes to maximum overall vehicle length can not be made under state jurisdiction, but require an “Act of Congress” to become final.

The Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991 froze the allowable length, weight and routes of LCVs. Recent requests to increase the length of Michigan log truck/trailer combinations from 70 to 75 feet have been denied at the federal level. Michigan’s logging interests had hoped that the length issue would be addressed in the reauthorization of TEA-21, but it was not. The federal restriction on the overall vehicle length of 70 feet, and hence the 75 foot crib-style vehicle, could be placed for consideration in the reauthorization of SAFETEA-LU.

Log Truck Inventory

The study area included all of the Upper Peninsula (U.P.) and the northern half of the Lower Peninsula (L.P.). The south boundary in the L.P. was state highway M-55, which bisects the state from Tawas City on Lake Huron, through West Branch and over to Manistee on Lake Michigan. Photos of sighted log trucks were taken at various monitoring sites and MDOT PRT sites and then analyzed to determine as many characteristics as possible: truck axles, trailer axles, self-loader, log load orientation, securement method, and other features.

Log hauling vehicles in Michigan come in a wide variety of configurations and sizes. According to several heavy truck dealers there is no such thing as a standard log truck and trailer, so if it is possible to haul logs on a particular configuration, someone probably has tried it. Truck and trailer configurations vary depending on location (especially if crossing state lines), typical road conditions (off-road use versus interstate highway), and type of load (saw logs versus pulpwood). Some rigs are designed for a special purpose such as long distance highway transport from a yard to a mill. Other setups are designed for maximum flexibility so that one load might be crosswise loaded pulpwood and the next load random length, lengthwise loaded saw logs. The configurations are constantly evolving as new technology becomes available, and operators strive for greater productivity and efficiency.

The two main classes of log hauling vehicles are the tractor and semi trailer combination and the truck and pup trailer combination. A third configuration, B-trains, with a tractor and two semi trailers are occasionally observed.

The majority (>80%) of the log hauling vehicles in the U.P. are 11 axle truck/pup trailer combinations with a self loader. This is a configuration that has evolved to meet the need for maneuverability and mobility of the U.P. timber producers and mills. Of the 11 axle Michigan rigs, 75% of the vehicles were 6 or 7 axle trucks pulling a 4 or 5 axle pup trailer. A Combined Gross Vehicle Weight Rating of 164,000 pounds is not uncommon. A 4 axle trailer is typically rated at 68,000 pounds, and the 5 axle trailer is rated at 71,000 pounds. The pup trailer has fewer axles, a shorter wheelbase and a higher center of gravity; all factors that decrease its stability compared to the truck. This is part of the reason that the pup trailers move side-to-side much more than the truck as the combination rig heads down the road. The increased side-to-side motion of a pup trailer leads to a greater risk of load loss.

Sightings at Stationary Monitoring Sites

Over 521 clearly identified sightings of log hauling vehicles make up the database of collected records. The frequency of log trucks sighted ranged from one truck every 4+ min. at Sagola, to one truck every 24+ min. at West Branch.

Overall, 67% of the sightings were 11 axle truck/pup trailer Michigan rigs. Around Escanaba, at the Bark River-Harris and Rapid River PTR's, the 11 axle Michigan rigs accounted for 81% of the log truck traffic, while no 11 axle Michigan rigs were seen on I-75 in West Branch.

Less than 8% of the log-hauling vehicles were the standard 5 axle tractor/semi trailer combination. However, in Ironwood and Iron River they accounted for roughly 40% of sightings, while only one of these rigs was recorded in the L.P. This is due to the lower weight limits and axle counts in Wisconsin and Minnesota. Around the International Paper mill in Quinnesec, which is also near the Wisconsin border, the 3+2 tractor semi trailers accounted for only 12% because larger trucks generally serve the pulp mill.

In West Branch, almost 30% of the log-hauling vehicles were B-trains and at Vanderbilt, 15% of the log trucks were B-trains. At monitoring sites in the Upper Peninsula, no B-trains were seen.

Stationary & Secondary Sites

During trips to logging conferences and safety inspections, short stays at major intersections, scouting near PTR locations, and visits to dealers, numerous secondary sightings of other log hauling vehicles were photographed and recorded. After combining all log hauling vehicles from the stationary and secondary sightings, the number of clearly identified vehicles increased to 636. Of these, 523 (82%) were the 11 axle truck/pup trailer combinations. The breakdown for 11 axle truck/ pup trailer combinations was: 7+4 (34%), 6S5 (29%), and 6+5 (37%). Self loaders were observed on 95% of the trucks.

Loading Orientation

The study clearly identified 338 loaded trucks; in this group, 86% were crosswise loaded, 12% lengthwise loaded, and 2% had a mix of both crosswise and lengthwise loading. Of the 404 loaded trailers; 80% were crosswise loaded, 19% lengthwise loaded, and 2% had a mix of both crosswise and lengthwise loading.

Securement Types

When the load securement method could be identified it was tracked for analysis. On trucks, 92% used chains and 8% used straps. On trailers, 84% used chains and 16% used straps. 46% of the trucks and 47% of the trailers were identified as crosswise loaded and secured with chains.

Size of the Michigan Log Truck Fleet

Several estimates on the size of the log truck fleet were made from data gathered during this study; through consultations with mill officials, operators, and insurance companies; and records obtained from the Information Services Division of the Michigan Department of State. Numbers obtained from the Michigan Department of State produced a total estimated log truck fleet size of 1,047 vehicles statewide. This number correlates well to the fleet size of 920 what was estimated by polling the major insurance carriers that extend insurance for log trucks.

Using the U.S. Forest Service report on the number of cords of wood harvested annually and discussions with loggers at the U.P. Log Truck Safety Inspections, a calculation was used to determine it would require a minimum of 661 trucks to move the recorded amount of timber harvested each year.

The best estimate is that at least 800 log trucks are active in Michigan in 2005. Approximately 75% of these vehicles are the 11 axle truck trailer combinations. The photographic database created during the inventory phase of this study, positively identified 373 unique vehicles during the twenty days of observation.

Crash Analysis

In the analysis of three years of U.P. crash data (2001, 2002, and 2003); there were a total of 96 crashes involving a log truck. This is an average of 32 crashes per year and represents 0.19% of all crashes in the U.P. and 6.6% of all truck/bus crashes in the U.P. There were three fatalities and three incapacitating injuries involving log trucks during the analysis period. The other driver was found at fault in all three fatal crashes.

The distribution of log truck crashes occurring within U.P. counties strongly follows the all-vehicle crash pattern and the truck/bus crash pattern within those counties. Even when using extremely conservative estimates of the number of log trucks and the number of vehicle miles traveled for log trucks, the total crash rates (number of crashes per 100 Million VMT) and injury crash rates (number of injury and possible injury crashes per 100 Million VMT) for log trucks were significantly lower than crash rates calculated for all U.P. traffic, for all Michigan traffic and for heavy truck traffic in the U.S. This indicates that log trucks generally pose less of a crash risk and injury risk per vehicle mile traveled than those other three categories. Fatality and incapacitating injury rates per vehicle mile traveled were also significantly lower than the rate for all U.P. traffic and equal to or less than the rate for all Michigan traffic.

Load Loss

Michigan State Police records show that over a seven-year period, 1998-2004, 100 incidents were reported in which logs were spilled or fell off of a log truck in the U.P. The first four years of the report show an average of 17.5 spills reported per year, while the last three years show an average of ten incidents. It has been over five years since a load loss from a logging truck has resulted in an injury or fatality.

Limited success was achieved in attempts to identify and contact log truck drivers who were involved in log spill incidents. Of the 100 reported incidents received by the Michigan State Police, only 32 had sufficient information to identify a company or an individual. This is due to the fact that in many of the log spill incidents reported, officers would arrive on the scene only to find logs on the side of the road, or to find the logs had been removed and no information was available on the truck.

During the course of this study it was learned that log spills occurred predominately in the U.P. and several contributing factors were found. First and probably the most significant factor is the truck volume. The quantity of timber hauled by a truck in the U.P. is greater than the L.P. The five largest U.P. mills receive and process 99,000 truckloads of pulpwood per year (this amount does not account for the truckloads that go to satellite yards for processing elsewhere) versus approximately 20,550 loads for the L.P.

The second contributing factor to spills in the U.P. is the weather. The longer winters mean many months of loading and transporting frozen, icy, and snow covered logs. Snow and ice between the logs decreases the log-to-log friction, reducing the lateral force that is needed to prevent the logs from sliding off the side of the vehicle.

A third contributing factor is the species and type of wood being hauled. Poplar is one of the most common pulpwood species. It is often twisted and irregular, not straight and uniform like a saw log. In the spring when the sap begins to flow, the bark peels off easily, creating slippery logs, reducing the log-to-log friction. It is frequently a much smaller diameter wood, resulting in more logs on a load.

Automatic Tensioners

Most of the log settling happens as the vehicle, loaded with non-uniform pieces, travels out of the woods on a rough and twisting logging road. Any settling of the load drastically reduces the tension in the tie-downs, and settling of more than one inch results in no tension in a conventional over-center binder or screw ratchet binder. Auto tensioners evolved because of a need for a securement binder that would accommodate the settling of a load of logs. Air binders are a practical solution because all large transport vehicles have an air supply for the air brakes.

During this study, air binders were found to be used on the vast majority of trailers operating in the U.P. (industry representatives say upwards of 90%). This is due in part to Dickinson County mandating air binder use on all trailers passing through the county.

Interestingly, air binders are not common in either the Lower Peninsula or Wisconsin. The use of this seemingly great idea appears to be limited to large pup trailers in the U.P. If air binders are so good, why are they not being adopted by all log haulers? The prevailing attitude appears to be that air binders are good, but not necessary in all applications. In Wisconsin the loads are much smaller due to the weight and axle limits, also lengthwise loading in crib style trailers is becoming more common. A high percentage of L.P. hauling is smaller, lengthwise loaded, random length logs headed to sawmills, and there is much less crosswise hauling of pulpwood.

Air Binder Types

Air binders provide an efficient method for maintaining chain tension as a load of logs settles. There are three main types of air binders currently in use:

- air bags - similar to those found on air bag suspensions and lift axle mechanisms
- air cylinders - similar to hydraulic cylinder but operated by air
- air chambers - same hardware that is used for air brakes

All three types of binders have proven to be effective. However, without any regulations on air binder design, less than desirable air binders have appeared.

Air Bags

The most common type of air binder is the air bag system. It is within this type that the greatest variety exists. Air bags, technically referred to as air spring actuators, range in size from six inches to over 36 inches in diameter and have useable stroke lengths from four to almost 14 inches. Some systems use dual air bags with an individual air bag for each chain. Other systems employ a single air bag to apply tension to two chains.

Air Cylinder

Another popular binder is the air cylinder. The air cylinder has been used as a log truck air binder since 1992. This cylinder has a three and one-half inch diameter bore, a one inch diameter rod, and an 18 inch long stroke. The force applied is directly related to the air system pressure and remains constant regardless of the rod position. These cylinders are being installed on new vehicles and several hundred units have been sold for retrofit situations.

Air Chamber

The newest idea in auto tensioners involves using an air brake chamber. A type 30 or 36 chamber is used with a three inch stroke. Due to the limited travel of an air chamber rod, a lever linkage is employed to produce a 10 inch take-up stroke. The resulting pull force is said to be comparable to that of an air cylinder; however, resulting force would be dependent upon the lever arm ratios. These air binders are taking advantage of a component that has been certified for an air brake system, so they should be very reliable.

Vehicle Attachment

One of the greatest concerns with overall tie-down strength is the use of welded chains and components, especially where they attach to the arms of an air binder system. High strength chains and hooks become brittle and lose strength when welded. Weld repaired chains are not allowed by law; so chains or hooks welded to air binders are all unacceptable.

Air Binder Recommendations

A design standard for automatic tensioners is provided in the Task 5 Report.

There are four criteria that determine the effectiveness of an air binder.

- stroke or take-up capability
- force
- air supply system
- attachment to the vehicle

Stroke or Take-up Capability

The take-up capability of air binders observed during the course of this study ranged from over 4 inches to over 18 inches. A take-up capability of 8 – 12 inches is desirable and sufficient.

The load of logs will always have its greatest amount of settling immediately after loading and while traveling on rough and twisting logging roads. It is common practice for an operator to check the securement system before entering a public road. Truckers with short stroke binders are more likely to stop and readjust. Drivers with the longer stroke binders almost never have to stop after the initial readjustment.

Force

The vast majority of log hauling vehicles use chains for their tie-downs. Michigan law requires chains with a Working Load Limit (WLL) of 4,700 pounds. At very high tension loads (greater than 3,000 pounds), the chains could cut through softer logs. The force generated by an air binder should create a tie-down tension of 1,000 – 3,000 pounds. Experience has shown that air cylinder systems with 1,000 pound capacity are adequate.

Forces greater than 3,000 pounds can be achieved with an over-center binder, but only if a “cheater bar” that extends the leverage is used. That force dwindles down to nothing if the load settles more than one inch. So, as mentioned in the stroke discussion, any air binder system is better than the traditional over-center or ratchet binders.

Air Supply Considerations

On a heavy vehicle, the primary purpose of the air system is to provide vehicle braking. All other air uses are secondary and must not degrade the brake system. Newer log truck/trailer combinations use air for numerous other purposes including air suspensions, lift axles, and air actuated clutches. When any air binder is added to a vehicle, two major concerns that require special attention are the compressor supply capability and reservoir capacity.

The air compressor must be able to recharge reservoirs as specified by federal regulations. There must also be sufficient air reservoirs to provide an air supply when the air compressor is off. Combination vehicles with 11 axles of air brakes, plus lift axles, require an engineered approach to compressor capability and reservoir capacity.

Vehicle Attachment

Air binders need to be firmly attached to the vehicle frame and capable of withstanding loads equal to or greater than the Working Load Limit of the tie-down, typically 4,700 pounds for each tie-down. Preferred methods of attaching chains to the arms of an air binder are with loops, tabs and clevises. Never weld a chain to an air binder system and do not weld hooks or clevises to an air binder unless the parts are specifically designed to be welded.

Tension Force Warning Devices

In the most ideal situation, the tension force in the tie-downs would be relayed to the driver with a separate indicator for each tie-down. If the driver knew that tension was changing, he could stop as soon as possible and make necessary adjustments. Using existing components, a force measuring system might be put together today for $10,000. With development, a wireless transmitter in a hermetically sealed load sensing unit may be able to be mass produced for $1,000 per tie-down.

Another possibility for warning devices would be through the use of limit switches. All automatic tensioners have the potential of stroking out – where all the take-up capability has been used up and the tie-down tension decreases to nothing. For the limit indicator signal to be transmitted to the driver from the rear of a trailer another wire has to be strung, with a connector between the truck and the trailer. Long wires and poor connections are a constant source of reliability problems for log truck operators.

Tie-down tension is only one part of the load loss issue. Other factors of equal importance for load loss are stacking, tree species, weather conditions, traveling speed, and road conditions. It is not possible to develop a warning device that addresses concerns for all these factors.

Acceptable Securement Methods

The tie-down system for securing a load is only as strong as its weakest link. Securement laws specify evaluation of the strength of all components in a tie-down. In Michigan, log hauling vehicles are required to have a tie-down system that has a Working Load Limit (WLL) of 4,700 pounds or $1/6^{th}$ of the payload, whichever is greater.

The North American Load Securement regulations, Section 393.116(4), states: "Each log that is not held in place by contact with other logs or the stakes, bunks, or standards must be held in place by a tie-down." For a tie-down to achieve contact with all logs on the top of the load, the load must be crowned. Crowning provides the best possibility for load stability and insures that the tie-downs provide proper tension to the entire load.

Bridging occurs when a chain touches a few logs and spans above most of the rest. It is a result of poor load stacking and increases the potential for a crosswise loaded log to slide outwards

The load securement laws allow the use of chains, cables, or straps for securing logs. Chains are the predominant choice of tie-down, especially in the Upper Peninsula where a 5/16 inch grade 70 chain is the most common tie-down used. Straps are becoming more prevalent in Wisconsin and the Lower Peninsula. Cables are almost never used, probably because of the difficulty in storing them.

No conclusion can be made as to whether straps or chains are better for securing logs. Both are acceptable, providing they meet stated size and strength requirements and are in good condition. For securing logs, it is more important to maintain adequate tension on the tie-down, than the type of tie-down.

The newest *North American Load Securement* regulations regarding logs simply states that if two chains are used to secure crosswise logs, the chains should be at placed at 1/3 intervals. Assuming a maximum nine foot length log, the chains should be placed three feet from the ends, thereby leaving three feet between chains. No scientific evidence was presented to explain the 1/3 spacing requirement.

Crib Style Loading vs. Traditional Crosswise Loading

A crib style log hauling vehicle is described as lengthwise loaded logs with lateral securement (bunks) and both a front and rear gate that prevents longitudinal shifting of the logs. Crib style trailers offer an improvement in log hauling safety.

Crib trailers are the current trend in Wisconsin. In fact, approximately 95% of new trailers being built in Wisconsin are crib style. Because of axle and weight limits, Wisconsin log haulers are almost always weight-limited before being volume-limited, therefore there is no economic penalty for lengthwise loading. The real advantage of the crib style trailers in Wisconsin has been the changes in load securement requirements. The Federal Motor Carriers Safety Administration (FMCSA) has ruled that in many cases lengthwise loaded crib trailers require no securement. Securement is required only when the lengthwise bundles are of different heights or large gaps exist between the bundles. The elimination of any securement requirements for lengthwise loaded crib style trailers has resulted in a huge time savings. Cribs are also being promoted from the safety aspect, not just on-the-road safety, but off-road safety as well (less time spent exposed to hazards in the woods).

Michigan truckers are not adopting the crib style at this time for two main reasons – load securement and load capacity. The load securement issue is simple—Michigan's load securement law requiring two tie-downs per bundle is more restrictive than the FMCSA regulations. The time required to attach and detach 12 tie-downs, compared to four tie-downs for a crosswise loaded vehicle, is a significant deterrent to the acceptance of crib hauling.

The main issue with crib style rigs in Michigan is the load capacity. Proponents of the Michigan cribs claimed that the overall combination vehicle length needed to be increased from 70 feet to 75 feet in order to carry the same weight and volume of logs as is legal when crosswise loaded. Overall combination vehicle lengths were frozen by an Act of Congress (Intermodal Surface Transportation Efficiency Act of 1991) so the State of Michigan did not have the authority to increase the length. Requests by Michigan for an increase in overall length at the federal level have been denied.

Probably the most likely way cribs would be adopted by Michigan log haulers was if the insurance companies significantly raised the rates for crosswise hauling while recognizing the lower risk (and lower premiums) for lengthwise hauling.

Other Alternatives

Another possible scenario for the acceptance of crib style vehicles in Michigan could come through an adoption of smaller vehicles. The current 11 axle rigs are preferred primarily because of the quantity of logs that can be carried. However, several sources have suggested that 7 or 8 axle rigs may make better economic sense. Initial costs are lower, operating costs are lower due to smaller engines, maintenance costs are lower due to fewer axles and they are easier to maneuver on tight logging roads. In addition, a fully loaded 11 axle rig cannot cross the Mackinaw Bridge or the bridge at Sault Ste. Marie into Canada because of the 144,000 pound bridge weight limits. The 11 axle rigs cannot operate in Wisconsin with their 6 axle truck and trailer limit.

The vast majority of Michigan log truck drivers today are dedicated professionals who are concerned with preserving their careers. They constantly strive to work more efficiently and safely. The insurance industry has been helpful in getting the “cowboys” off the road. The current log transportation system appears to be safe and efficient. Changes in transportation efficiency need to be carefully evaluated because there will be a wide ranging impact. If cost effective improvements can be made, the industry will make them.

Conclusions

- Crosswise loaded pup trailers will continue to present a spill risk, but the hundreds of thousands of loads that are hauled annually without incident indicate that this is an acceptable transportation method.
- Automatic tensioners are helpful for securing a load of logs, but they are not the sole solution for preventing log spills.
- Crib style vehicles, where lateral securement is built into the vehicle, are not being readily adopted in Michigan due to the reduced capacity and tie-down requirements.
- The distribution and patterns of log truck crashes are similar to that of all traffic in the U.P. and truck/bus traffic in the U.P.
- The crash rate for log trucks, crashes per 100 million miles traveled, is less than that for all traffic in the U.P., all traffic in Michigan, and all heavy truck/bus traffic in the U.S.
- Fatality and incapacitating injury rates are significantly lower than the rates for all U.P. traffic and equal to or less than the rate for all Michigan traffic.
- The insurance industry has been and will continue to be instrumental in getting high risk drivers and vehicles off the road.

Recommendations

- The Michigan timber industry should continue to educate log truck drivers on proper loading and securement techniques.
- The Michigan State Police Motor Carrier Division should continue to offer Log Truck Inspections on an annual basis. Mills are willing to support this effort.
- Michigan should consider adoption of the latest Federal Motor Carrier Safety Administration’s interpretation of tie-down requirements for crib style vehicles.
- Crib style vehicles should be encouraged.
- Automatic tensioners should be encouraged, especially on trailers.
- Begin classifying log truck load loss as part of the crash reporting.
- Develop a better log truck crash reporting process.
- A feasibility study could be conducted to determine if smaller 7 or 8 axle truck trailer combinations are an economically viable option.

Appendices

Appendix 1

JENNIFER M. GRANHOLM
GOVERNOR

STATE OF MICHIGAN
DEPARTMENT OF TRANSPORTATION
LANSING

GLORIA J. JEFF
DIRECTOR

September 18, 2003

Mr. James Steele
Division Administrator
Federal Highway Administration
315 West Allegan Street, Room 211
Lansing, Michigan 48933

Dear Mr. Steele:

The Michigan Department of Transportation (MDOT) is in receipt of an application for an extended transportation permit on state trunklines from Casperson Brothers Logging of Escanaba and Anthony P. Bellmore Inc. of Quinnesec (copies enclosed). These permit applications are for a total truck/semi-trailer length of 72 feet and 75 feet respectively. The length exceeds both state and federal truck length standards and therefore falls outside the normal parameters of our permitting process.

We are requesting Federal Highways Administration's (FHWA) guidance on this issue and whether MDOT can issue a permit for truck-tractor and semi-trailer/trailer combinations of these lengths. We have informed the applicants that a response to their request may take more than MDOT's normal 15 day processing time for extended permits.

We look forward to hearing from you. If you have any questions or concerns on this matter, please contact me at (517) 373-7368.

Sincerely,

Ronald K. DeCook

Ronald K. DeCook
Director of Governmental Affairs

Enclosures
cc: Gloria J. Jeff
Kirk Steudle
Larry Tibbits

U.S. Department
of Transportation

**Federal Highway
Administration**

Michigan Division

315 W. Allegan St., Room 207
Lansing, Michigan 48933

October 3, 2003

Mr. Ronald K. DeCook, Director
Governmental Affairs (B445)
Michigan Department of Transportation
Lansing, Michigan

Dear Mr. DeCook:

<u>Log Truck Permits</u>

Your letter of September 18, 2003, asked if MDOT could issue permits for two over length log truck/trailer combinations. As noted in your letter, the trucks exceed the length limits specified under current law. Accordingly, there is no legal basis for issuing permits for these vehicles. Such action would jeopardize the annual size and weight certification under the requirements of 23 CFR 657 and would require FHWA to seek injunctive relief against Michigan, as authorized by 49 U.S.C. 31115

Sincerely,

Original signed by:

Donald J. Cameron
Planning & Program Development Mgr.

For: James J. Steele
Division Administrator

cc: Gloria Jeff, MDOT (B450)
Kirk Steudle, MDOT (B450)
Larry Tibbits, MDOT (B450

Appendix 1

JENNIFER M. GRANHOLM
GOVERNOR

STATE OF MICHIGAN
DEPARTMENT OF TRANSPORTATION
LANSING

GLORIA J. JEFF
DIRECTOR

October 16, 2003

NOTE: THIS IS A COPY OF THE LETTER THAT WAS SENT TO BOTH BELLMORE AND CASPERSON

Dear :

Subject: Enclosed Application for an Extended Transportation Permit

This letter is to advise you that we are unable to issue a transport permit for the vehicle described in the enclosed application.

Based on a review of the application by the Michigan Department of Transportation (MDOT) and the Federal Highway Administration (FHWA), it has been determined that we are unable to issue a permit for this load. This decision was based on the overall length of the unit and the fact that it is a divisible load, and therefore, can be transported in smaller quantities that will not require permits.

If you have any questions regarding this matter or need additional information, please contact me at 517-373-7680.

Sincerely,

Mark A. Dionise

Mark A. Dionise, P.E.
Utility Coordination & Permits Section Manager
Real Estate Support Area

Enclosure
cc: R. DeCook
M. DeLong

Appendix 2

U.S. Department of Transportation
Federal Motor Carrier Safety Administration

Office of the Administrator

400 - Seventh St., SW
Washington, DC 20590

DEC 30 2003

Refer to: MC-PSV

Mr. Alan Hastreiter
Executive Director
Timber Producers Association of
Michigan & Wisconsin
P.O. Box 1278
Rhinelander, WI 54501

Dear Mr. Hastreiter:

Thank you for your November 13 letter to Robert Proferes, Director of the Office of Bus and Truck Standards and Operations, requesting clarification of the Federal Motor Carrier Safety Administration's (FMCSA) cargo securement rules.

You indicated the forest products industry has expressed an interest in using a crib-type system for transporting logs and pulpwood. Such systems are typically based, in whole or in part, upon a patented design, "Apparatus for Constraining the Position of Logs on a Truck Trailer" (Patent No. US 6,572,314 B2). These systems use stakes, bunks, a front-end structure, and a rear-end structure to restrain logs on trailers. The stakes prevent movement of the logs from side to side on the vehicle while the front- and rear-end structures prevent movement of the logs from front to back on the vehicle. The intent of such systems is to enable motor carriers to transport logs without the use of wrapper chains or straps to secure the load, thereby expediting the loading and unloading process. You wanted to know if the use of crib-type securement systems, without wrappers or tiedowns, would satisfy the requirements of 49 CFR 393.116.

Generally, the use of a crib-type log securement system, without wrappers or tiedowns, would satisfy the commodity-specific requirements of § 393.116 provided:

(1) All vehicle components in the crib-type system are designed and built to withstand all anticipated operational forces without failure, accidental release or permanent deformation. Stakes or standards that are not permanently attached to the vehicle must be secured in a manner that prevents unintentional separation from the vehicle in transit [49 CFR 393.116(b)(2)];

(2) Logs are solidly packed, with the outer bottom logs in contact with and resting solidly against the bunks, bolsters, stakes or standards [49 CFR 393.116(c)(1)];

(3) Each outside log on the side of a stack of logs must touch at least two stakes, bunks, bolsters, or standards. If one end does not actually touch a stake, it must rest on other logs in a stable manner and must extend beyond the stake, bunk, bolster or standard [49 CFR 393.116(c)(2)];

Appendix 2

(4) The maximum height of each stack of logs being transported is below the height of the stakes, and the front- and rear-end structures; and,

(5) The heights of the stacks are approximately equal so that logs in the top of one stack cannot shift longitudinally onto another stack on the vehicle.

Section 393.116(b)(3), which requires that tiedowns be used in combination with the stabilization provided by bunks, stakes and bolsters to secure loads of logs, should not be considered applicable to the transportation of logs on crib-type vehicles under the conditions listed above. However, § 393.116(c)(4), also concerning tiedowns, remains applicable for logs that are not held in place by contact with other logs or the stakes, bunks, or standards. This means the decision whether tiedowns must be used is contingent upon how the logs are loaded onto the vehicle. If the tops of the stacks of logs are relatively level, then tiedowns would not be required when the logs are transported in crib-type vehicles, while uneven loads would require tiedowns on the taller stacks, and on logs that are not held in place by other logs, bunks, or standards.

I hope this information is helpful. If you have any additional questions please contact Larry W. Minor, Chief of FMCSA's Vehicle and Roadside Operations Division, at 202-366-4009, or e-mail him at larry.minor@fmcsa.dot.gov.

Sincerely yours,

Warren E. Hoemann
Deputy Administrator for

John H. Hill
Assistant Administrator
and Chief Safety Officer

MichiganTech

Record No.___________________
Vehicle No.___________________

LOG TRUCK INVENTORY FORM

Date / Time: ____________________ **Location:** ________________________________
Photo Nos: _______________________________________ **Best Photo** ____________

Configuration / Axle Count: ______________

Truck **Trailer** **Tractor** **Semi-Trailer** **B-Train** **Other**

Identifiers/Handle:
____

Truck:

Owner: ____
Home: _____________________________
USDOT: ___________________________ **LC:** ________________________________
Empty Weight: ________________

Color: ________________________ **Make:** ____________________________
Plate: State: ____ **No.** _________________ **MI LOG FARM: Y / N**
Empty / Loaded **Lengthwise / Crosswise / Mixed** **Chains / Straps**
Stakes _____________ **Mud Flaps** ______________ **Wheels** _______________
Other Features ____

Trailer:

Color: _________________ **Make:** ____________________________
Plate: State: ____ **No.** _________________
Empty / Loaded **Lengthwise / Crosswise / Mixed** **Chains / Straps**
Stakes _____________ **Mud Flaps** ______________ **Wheels** _______________
Other Features ____

Loader:

None / Truck Rear / Trailer Center / Other _______________________
Mfg. ___________________ **Model**________________________
Color (Base/Boom) ___________________________
Other Features ____

Axle No.	1	2	3	4	5	6	7	8	9	10	11
Type											
Wheels											
Weight (klb)											

Types: S = Steer, P = Pusher, D = Drive, T = Tag, L = Liftable, D = Dolly, S = Straight
Wheels: S = Single, SS = Super Single, D = Dual
Weight: 18K on 9-ft spreads, 16K on 9-ft spread tandems, 13K most others, 9K less than 40”;
700 lb/in = 14K for 10” (S), 15.4K for 11” or 18K for 13” (SS or D)

Record No.___________________
Vehicle No.___________________

Truck/Tractor ______________ **Trailer** __________________ **GCWVR** ________________

Comments: ____

Appendix 4 consists of the inventory database as MS Excel files. This data has been submitted on a CD-ROM with the Final Report.

MICHIGAN VEHICLE CODE (EXCERPT)
Act 300 of 1949

257.801 Registration taxes on vehicles; schedules; computation; exemption from ad valorem taxes on vehicles in stock or bond; increase and disposition of certain taxes; late fee; definitions.

Sec. 801. (1) The secretary of state shall collect the following taxes at the time of registering a vehicle, which shall exempt the vehicle from all other state and local taxation, except the fees and taxes provided by law to be paid by certain carriers operating motor vehicles and trailers under the motor carrier act, 1933 PA 254, MCL 475.1 to 479.43; the taxes imposed by the motor carrier fuel tax act, 1980 PA 119, MCL 207.211 to 207.234; and except as otherwise provided by this act:

(a) For a motor vehicle, including a motor home, except as otherwise provided, and a pickup truck or van that weighs not more than 8,000 pounds, except as otherwise provided, according to the following schedule of empty weights:

Empty weights	Tax
0 to 3,000 pounds	$ 29.00
3,001 to 3,500 pounds	32.00
3,501 to 4,000 pounds	37.00
4,001 to 4,500 pounds	43.00
4,501 to 5,000 pounds	47.00
5,001 to 5,500 pounds	52.00
5,501 to 6,000 pounds	57.00
6,001 to 6,500 pounds	62.00
6,501 to 7,000 pounds	67.00
7,001 to 7,500 pounds	71.00
7,501 to 8,000 pounds	77.00
8,001 to 8,500 pounds	81.00
8,501 to 9,000 pounds	86.00
9,001 to 9,500 pounds	91.00
9,501 to 10,000 pounds	95.00
over 10,000 pounds	$ 0.90 per 100 pounds of empty weight

On October 1, 1983, and October 1, 1984, the tax assessed under this subdivision shall be annually revised for the registrations expiring on the appropriate October 1 or after that date by multiplying the tax assessed in the preceding fiscal year times the personal income of Michigan for the preceding calendar year divided by the personal income of Michigan for the calendar year that preceded that calendar year. In performing the calculations under this subdivision, the secretary of state shall use the spring preliminary report of the United States department of commerce or its successor agency. A van that is owned by an individual who uses a wheelchair or by an individual who transports a resident of his or her household who uses a wheelchair and for which registration plates are issued under section 803d shall be assessed at the rate of 50% of the tax provided for in this subdivision.

(b) For a trailer coach attached to a motor vehicle, the tax shall be assessed as provided in subdivision (*l*). A trailer coach not under 1959 PA 243, MCL 125.1035 to 125.1043, and while located on land otherwise assessable as real property under the general property tax act, 1893 PA 206, MCL 211.1 to 211.157, if the trailer coach is used as a place of habitation, and whether or not permanently affixed to the soil, is not exempt from real property taxes.

(c) For a road tractor, truck, or truck tractor owned by a farmer and used exclusively in connection with a farming operation, including a farmer hauling livestock or farm equipment for other farmers for remuneration in kind or in labor, but not for money, or used for the transportation of the farmer and the farmer's family, and not used for hire, 74 cents per 100 pounds of empty weight of the road tractor, truck, or truck tractor. If the road tractor, truck, or truck tractor owned by a farmer is also used for a nonfarming operation, the farmer is subject to the highest registration tax applicable to the nonfarm use of the vehicle but is not subject to more than 1 tax rate under this act.

(d) For a road tractor, truck, or truck tractor owned by a wood harvester and used exclusively in connection with the wood harvesting operations or a truck used exclusively to haul milk from the farm to the first point of delivery, 74 cents per 100 pounds of empty weight of the road tractor, truck, or truck tractor. A registration secured by payment of the fee as prescribed in this subdivision continues in full force and effect until the regular expiration date of the registration. As used in this subdivision, "wood harvester" includes the person or persons hauling and transporting raw materials in the form produced at the harvest site. As used in this subdivision, "wood harvesting operations" does not include the transportation of processed lumber, Christmas trees, or processed firewood for a profit making venture.

(e) For a hearse or ambulance used exclusively by a licensed funeral director in the general conduct of the licensee's funeral business, including a hearse or ambulance whose owner is engaged in the business of leasing or renting the hearse or ambulance to others, $1.17 per 100 pounds of the empty weight of the hearse or ambulance.

(f) For a vehicle owned and operated by this state, a state institution, a municipality, a privately incorporated, nonprofit volunteer fire department, or a nonpublic, nonprofit college or university, $5.00 per plate. A registration plate issued under this subdivision expires on June 30 of the year in which new registration plates are reissued for all vehicles by the secretary of state.

(g) For a bus including a station wagon, carryall, or similarly constructed vehicle owned and operated by a nonprofit parents' transportation corporation used for school purposes, parochial school or society, church Sunday school, or any other grammar school, or by a nonprofit youth organization or nonprofit rehabilitation facility; or a motor vehicle owned and operated by a senior citizen center, $10.00 per set, if the bus, station wagon, carryall, or similarly constructed vehicle or motor vehicle is designated by proper signs showing the organization operating the vehicle.

(h) For a vehicle owned by a nonprofit organization and used to transport equipment for providing dialysis treatment to children at camp; for a vehicle owned by the civil air patrol, as organized under 36 USC 40301 to 40307, $10.00 per plate, if the vehicle is designated by a proper sign showing the civil air patrol's name; for a vehicle owned and operated by a nonprofit veterans center; for a vehicle owned and operated by a nonprofit recycling center or a federally recognized nonprofit conservation organization; for a motor vehicle having a truck chassis and a locomotive or ship's body that is owned by a nonprofit veterans organization and used exclusively in parades and civic events; or for an emergency support vehicle used exclusively for emergencies and owned and operated by a federally recognized nonprofit charitable organization, $10.00 per plate.

(i) For each truck owned and operated free of charge by a bona fide ecclesiastical or charitable corporation, or red cross, girl scout, or boy scout organization, 65 cents per 100 pounds of the empty weight of the truck.

(j) For each truck, weighing 8,000 pounds or less, and not used to tow a vehicle, for each privately owned truck used to tow a trailer for recreational purposes only and not involved in a profit making venture, and for each vehicle designed and used to tow a mobile home or a trailer coach, except as provided in subdivision (b), $38.00 or an amount computed according to the following schedule of empty weights, whichever is greater:

Empty weights	Per 100 pounds
0 to 2,500 pounds	$ 1.40
2,501 to 4,000 pounds	1.76
4,001 to 6,000 pounds	2.20
6,001 to 8,000 pounds	2.72
8,001 to 10,000 pounds	3.25
10,001 to 15,000 pounds	3.77
15,001 pounds and over	4.39

If the tax required under subdivision (p) for a vehicle of the same model year with the same list price as the vehicle for which registration is sought under this subdivision is more than the tax provided under the preceding provisions of this subdivision for an identical vehicle, the tax required under this subdivision is not less than the tax required under subdivision (p) for a vehicle of the same model year with the same list price.

(k) For each truck weighing 8,000 pounds or less towing a trailer or any other combination of vehicles and for each truck weighing 8,001 pounds or more, road tractor or truck tractor, except as provided in subdivision (j) according to the following schedule of elected gross weights:

Elected gross weight	Tax
0 to 24,000 pounds	$ 491.00
24,001 to 26,000 pounds	558.00
26,001 to 28,000 pounds	558.00
28,001 to 32,000 pounds	649.00
32,001 to 36,000 pounds	744.00
36,001 to 42,000 pounds	874.00
42,001 to 48,000 pounds	1,005.00
48,001 to 54,000 pounds	1,135.00

54,001 to 60,000 pounds	1,268.00
60,001 to 66,000 pounds	1,398.00
66,001 to 72,000 pounds	1,529.00
72,001 to 80,000 pounds	1,660.00
80,001 to 90,000 pounds	1,793.00
90,001 to 100,000 pounds	2,002.00
100,001 to 115,000 pounds	2,223.00
115,001 to 130,000 pounds	2,448.00
130,001 to 145,000 pounds	2,670.00
145,001 to 160,000 pounds	2,894.00
over 160,000 pounds	3,117.00

For each commercial vehicle registered under this subdivision, $15.00 shall be deposited in a truck safety fund to be expended for the purposes prescribed in section 25 of 1951 PA 51, MCL 247.675.

If a truck or road tractor without trailer is leased from an individual owner-operator, the lessee, whether a person, firm, or corporation, shall pay to the owner-operator 60% of the tax prescribed in this subdivision for the truck tractor or road tractor at the rate of 1/12 for each month of the lease or arrangement in addition to the compensation the owner-operator is entitled to for the rental of his or her equipment.

(*l*) For each pole trailer, semitrailer, trailer coach, or trailer, the tax shall be assessed according to the following schedule of empty weights:

Empty weights	Tax
0 to 2,499 pounds	$ 75.00
2,500 to 9,999 pounds	200.00
10,000 pounds and over	300.00

The registration plate issued under this subdivision expires only when the secretary of state reissues a new registration plate for all trailers. If the secretary of state reissues a new registration plate for all trailers, a person who has once paid the tax for a vehicle under this subdivision is not required to pay the tax for that vehicle a second time, but is required to pay only the cost of the reissued plate at the rate provided in section 804(2) for a standard plate. A registration plate issued under this subdivision is nontransferable.

(m) For each commercial vehicle used for the transportation of passengers for hire except for a vehicle for which a payment is made under 1960 PA 2, MCL 257.971 to 257.972, according to the following schedule of empty weights:

Empty weights	Per 100 pounds
0 to 4,000 pounds	$ 1.76
4,001 to 6,000 pounds	2.20
6,001 to 10,000 pounds	2.72
10,001 pounds and over	3.25
(n) For each motorcycle	$ 23.00

On October 1, 1983, and October 1, 1984, the tax assessed under this subdivision shall be annually revised for the registrations expiring on the appropriate October 1 or after that date by multiplying the tax assessed in the preceding fiscal year times the personal income of Michigan for the preceding calendar year divided by the personal income of Michigan for the calendar year that preceded that calendar year. In performing the calculations under this subdivision, the secretary of state shall use the spring preliminary report of the United States department of commerce or its successor agency.

Beginning January 1, 1984, the registration tax for each motorcycle is increased by $3.00. The $3.00 increase is not part of the tax assessed under this subdivision for the purpose of the annual October 1 revisions but is in addition to the tax assessed as a result of the annual October 1 revisions. Beginning January 1, 1984, $3.00 of each motorcycle fee shall be placed in a motorcycle safety fund in the state treasury and shall be used only for funding the motorcycle safety education program as provided for under sections 312b and 811a.

(o) For each truck weighing 8,001 pounds or more, road tractor, or truck tractor used exclusively as a moving van or part of a moving van in transporting household furniture and household effects or the equipment or those engaged in conducting carnivals, at the rate of 80% of the schedule of elected gross weights in subdivision (k) as modified by the operation of that subdivision.

(p) After September 30, 1983, each motor vehicle of the 1984 or a subsequent model year as shown on the application required under section 217 that has not been previously subject to the tax rates of this section and that is of the motor vehicle category otherwise subject to the tax schedule described in subdivision (a), and each low-speed vehicle according to the following schedule based upon registration periods of 12 months:

(*i*) Except as otherwise provided in this subdivision, for the first registration that is not a transfer registration under section 809 and for the first registration after a transfer registration under section 809, according to the following schedule based on the vehicle's list price:

List Price	Tax
$ 0 - $ 6,000.00	$ 30.00
More than $ 6,000.00 - $ 7,000.00	$ 33.00
More than $ 7,000.00 - $ 8,000.00	$ 38.00
More than $ 8,000.00 - $ 9,000.00	$ 43.00
More than $ 9,000.00 - $ 10,000.00	$ 48.00
More than $ 10,000.00 - $ 11,000.00	$ 53.00
More than $ 11,000.00 - $ 12,000.00	$ 58.00
More than $ 12,000.00 - $ 13,000.00	$ 63.00
More than $ 13,000.00 - $ 14,000.00	$ 68.00
More than $ 14,000.00 - $ 15,000.00	$ 73.00
More than $ 15,000.00 - $ 16,000.00	$ 78.00
More than $ 16,000.00 - $ 17,000.00	$ 83.00
More than $ 17,000.00 - $ 18,000.00	$ 88.00
More than $ 18,000.00 - $ 19,000.00	$ 93.00
More than $ 19,000.00 - $ 20,000.00	$ 98.00
More than $ 20,000.00 - $ 21,000.00	$ 103.00
More than $ 21,000.00 - $ 22,000.00	$ 108.00
More than $ 22,000.00 - $ 23,000.00	$ 113.00
More than $ 23,000.00 - $ 24,000.00	$ 118.00
More than $ 24,000.00 - $ 25,000.00	$ 123.00
More than $ 25,000.00 - $ 26,000.00	$ 128.00
More than $ 26,000.00 - $ 27,000.00	$ 133.00
More than $ 27,000.00 - $ 28,000.00	$ 138.00
More than $ 28,000.00 - $ 29,000.00	$ 143.00
More than $ 29,000.00 - $ 30,000.00	$ 148.00

More than $30,000.00, the tax of $148.00 is increased by $5.00 for each $1,000.00 increment or fraction of a $1,000.00 increment over $30,000.00. If a current tax increases or decreases as a result of 1998 PA 384, only a vehicle purchased or transferred after January 1, 1999 shall be assessed the increased or decreased fee.

(*ii*) For the second registration, 90% of the tax assessed under subparagraph (*i*).

(*iii*) For the third registration, 90% of the tax assessed under subparagraph (*ii*).

(*iv*) For the fourth and subsequent registrations, 90% of the tax assessed under subparagraph (*iii*).

For a vehicle of the 1984 or a subsequent model year that has been previously registered by a person other than the person applying for registration or for a vehicle of the 1984 or a subsequent model year that has been previously registered in another state or country and is registered for the first time in this state, the tax under this subdivision shall be determined by subtracting the model year of the vehicle from the calendar year for which the registration is sought. If the result is zero or a negative figure, the first registration tax shall be paid. If the result is 1, 2, or 3 or more, then, respectively, the second, third, or subsequent registration tax shall be paid. A van that is owned by an individual who uses a wheelchair or by an individual who transports a resident of his or her household who uses a wheelchair and for which registration plates are issued under section 803d shall be assessed at the rate of 50% of the tax provided for in this subdivision.

(q) For a wrecker, $200.00.

(r) When the secretary of state computes a tax under this section, a computation that does not result in a whole dollar figure shall be rounded to the next lower whole dollar when the computation results in a figure ending in 50 cents or less and shall be rounded to the next higher whole dollar when the computation results in a figure ending in 51 cents or more, unless specific taxes are specified, and the secretary of state may accept the manufacturer's shipping weight of the vehicle fully equipped for the use for which the registration application is made. If the weight is not correctly stated or is not satisfactory, the secretary of state shall determine the actual weight. Each application for registration of a vehicle under subdivisions (j) and (m) shall have attached to the application a scale weight receipt of the vehicle fully equipped as of the time the application is made. The scale weight receipt is not necessary if there is presented with the application a registration receipt of the previous year that shows on its face the weight of the motor vehicle as registered with the secretary of state and that is accompanied by a statement of the applicant that there has not been a structural change in the motor vehicle that has increased the weight and that the previous registered weight is the true weight.

(2) A manufacturer is not exempted under this act from paying ad valorem taxes on vehicles in stock or bond, except on the specified number of motor vehicles registered. A dealer is exempt from paying ad valorem taxes on vehicles in stock or bond.

(3) Until October 1, 2009, the tax for a vehicle with an empty weight over 10,000 pounds imposed under subsection (1)(a) and the taxes imposed under subsection (1)(c), (d), (e), (f), (i), (j), (m), (o), and (p) are each increased as follows:

(a) A regulatory fee of $2.25 that shall be credited to the traffic law enforcement and safety fund created in section 819a and used to regulate highway safety.

(b) A fee of $5.75 that shall be credited to the transportation administration collection fund created in section 810b.

(4) If a tax required to be paid under this section is not received by the secretary of state on or before the expiration date of the registration plate, the secretary of state shall collect a late fee of $10.00 for each registration renewed after the expiration date. An application for a renewal of a registration using the regular mail and postmarked before the expiration date of that registration shall not be assessed a late fee. The late fee collected under this subsection shall be deposited into the general fund.

(5) As used in this section:

(a) "Gross proceeds" means that term as defined in section 1 of the general sales tax act, 1933 PA 167, MCL 205.51, and includes the value of the motor vehicle used as part payment of the purchase price as that value is agreed to by the parties to the sale, as evidenced by the signed agreement executed under section 251.

(b) "List price" means the manufacturer's suggested base list price as published by the secretary of state, or the manufacturer's suggested retail price as shown on the label required to be affixed to the vehicle under section 2 of the automobile information disclosure act, 15 USC 1232, if the secretary of state has not at the time of the sale of the vehicle published a manufacturer's suggested retail price for that vehicle, or the purchase price of the vehicle if the manufacturer's suggested base list price is unavailable from the sources described in this subdivision.

(c) "Purchase price" means the gross proceeds received by the seller in consideration of the sale of the motor vehicle being registered.

History: 1949, Act 300, Eff. Sept. 23, 1949;—Am. 1951, Act 55, Eff. Dec. 1, 1951;—Am. 1952, Act 161, Eff. Sept. 18, 1952;—Am. 1953, Act 179, Imd. Eff. June 8, 1953;—Am. 1954, Act 147, Eff. Aug. 13, 1954;—Am. 1956, Act 130, Eff. Aug. 11, 1956;—Am. 1957, Act 90, Eff. Sept. 27, 1957;—Am. 1960, Act 104, Imd. Eff. Apr. 26, 1960;—Am. 1962, Act 82, Eff. Mar. 28, 1963;—Am. 1963, Act 41, Eff. Sept. 6, 1963;—Am. 1967, Ex. Sess., Act 3, Imd. Eff. Nov. 15, 1967;—Am. 1969, Act 309, Imd. Eff. Aug. 14, 1969;—Am. 1970, Act 106, Imd. Eff. July 23, 1970;—Am. 1976, Act 26, Imd. Eff. Feb. 27, 1976;—Am. 1976, Act 114, Imd. Eff. May 14, 1976;—Am. 1976, Act 439, Imd. Eff. Jan. 13, 1977;—Am. 1976, Act 441, Eff. Mar. 31, 1977;—Am. 1978, Act 427, Imd. Eff. Sept. 30, 1978;—Am. 1979, Act 47, Imd. Eff. July 3, 1979;—Am. 1980, Act 117, Imd. Eff. May 14, 1980;—Am. 1980, Act 153, Imd. Eff. June 11, 1980;—Am. 1980, Act 270, Imd. Eff. Oct. 1, 1980;—Am. 1981, Act 58, Imd. Eff. June 4, 1981;—Am. 1982, Act 187, Eff. Jan. 1, 1984;—Am. 1982, Act 350, Imd. Eff. Dec. 21, 1982;—Am. 1982, Act 439, Eff. Jan. 1, 1983;—Am. 1983, Act 165, Eff. Oct. 1, 1983;—Am. 1984, Act 173, Imd. Eff. June 29, 1984;—Am. 1985, Act 32, Imd. Eff. June 13, 1985;—Am. 1987, Act 238, Imd. Eff. Dec. 28, 1987;—Am. 1988, Act 346, Imd. Eff. Oct. 25, 1988;—Am. 1990, Act 181, Imd. Eff. July 18, 1990;—Am. 1994, Act 50, Imd. Eff. Mar. 25, 1994;—Am. 1994, Act 94, Imd. Eff. Apr. 13, 1994;—Am. 1994, Act 95, Eff. June 1, 1994;—Am. 1994, Act 395, Eff. Mar. 30, 1995;—Am. 1995, Act 129, Imd. Eff. June 30, 1995;—Am. 1995, Act 226, Imd. Eff. Dec. 14, 1995;—Am. 1997, Act 80, Eff. Oct. 1, 1997;—Am. 1998, Act 384, Eff. Jan. 1, 1999;—Am. 2000, Act 47, Imd. Eff. Mar. 27, 2000;—Am. 2000, Act 82, Eff. July 1, 2000;—Am. 2000, Act 502, Imd. Eff. Jan. 11, 2001;—Am. 2002, Act 417, Imd. Eff. June 5, 2002;—Am. 2003, Act 152, Eff. Oct. 1, 2003;—Am. 2004, Act 427, Imd. Eff. Dec. 17, 2004.

MTU REVIEW OF NMU SURVEYS

In 2004 Northern Michigan University (NMU) Public Policy students, with support from the Governor's Office for the Upper Peninsula, conducted surveys at three UP spring logging conferences in Newberry, L'Anse, and Iron Mountain. There were 311 questionnaires returned. 74% of the respondents were log truck drivers. The average years of driving log trucks were 13 years and 60% had over 10 years.

Survey Responses

Zero and Non-drivers	19%
1 – 5 years	15%
6 – 10 years	17%
11 – 20 years	24%
21+ years	25%

When queried as to the number one cause of spills, 26% responded with "Careless Loading". The other factors that ranged in frequency of response from11% to 14% included: excess speed, improper use of equipment (chains), operator error/inexperience, and road conditions.

Survey Responses

Careless Loading	26%
Improper Use of Equipment (chains)	13%
Excess Speed	14%
Operator Error / Inexperience	12%
Other Driver Error	9%
Road Conditions	11%
Other	11%

When asked how spills could be eliminated, 21% responded that crib trailers were a solution, 19% recommended air binders and 18% said loading and checking procedures. Many (24% - the greatest response) responded that "other factors" needed to be addressed such as: enforcing laws, speed limits, and public education on the braking capabilities of log trucks.

Survey Responses

Air Binders / Chains (Tighteners)	19%
Responsible Loading & Checking Procedures	18%
Responsible Driving	11%
Road Conditions	7%
Crib Trailers	21%
Other	24%

Greater than one third (34%) responded that additional driver training would reduce the number of spills. Information and training on proper loading and techniques was cited by 23%.

Survey Responses

Driver Training	34%
Proper Loading Training / Technique	23%
Periodic Load Checks	6%

In regards to crib style log hauling vehicles, two-thirds (67%) considered cribs to be safer primarily because the load was more secure. Those that did not think cribs were safer said that safety was dependent on the driver and that it was still possible to lose logs. Almost two-thirds (63%) replied that a profitable crib truck could not be designed within the existing 70-foot length limitation. 52% of the respondents would not purchase or convert to crib style citing loss of load capacity, difficulty in loading and unloading, time to secure and a general loss of money.

Survey Responses

Is a Crib Truck Design Safer? 67% Yes	33% No	1% Unsure	
Can a profitable crib truck be designed at 70 ft?	30% yes	63% No	7% other
Would you purchase or convert to a crib?	48% Yes	52% No	

In 2005 NMU followed up with a second questionnaire at logging conferences in Iron Mountain, L'Anse and Wakefield. Over 400 people participated, with 50% identifying themselves as log truck drivers.

2005 Survey Questions

(1) Should log truck safety training be an industry standard?

83% responded YES, with only a slight difference between the drivers and non-drivers.

(2) Do you think SFI regulations should include safety training for log truck drivers?

75% responded YES, including over two-thirds of the drivers.

(3) Drivers were then queried as to what types of training they would like to see. The greatest response was for *Proper Loading and Tie Down* closely followed by *Driving and Cornering Techniques*. *Loader Operator Training* and *Skid Pad Training* were also mentioned but each received about two-thirds the requests as the first two categories.

The NMU results are on a bar chart and exact numbers are not available. Drivers were allowed to check as many categories as appropriate. The bar chart is in units of *Driver Requests*.

Driver Requests

Driving and Cornering Techniques	455 requests
Skid Pad Training	295 requests
Proper Loading & Tiedown	475 requests
Loader Operator Training	300 requests

(4) Finally, drivers were asked to identify on a map “Spill Prone Locations” and locations where a “Safety Turnout is Needed”. This information has been forwarded to the MDOT Superior Region office in Escanaba for future planning.

Comments on the NMU survey relative to MTU Log Truck Study

First it is interesting to note that the number of participants that identified themselves as log truck drivers was just over 200 each year. This number is at the low end of the estimate of the number of log hauling trucks in the UP.

Second, in reading the comments that accompanied the questionnaire, one comes away with the underlying tone that log hauling safety has much more to do with the driver than it does the equipment. Crib style vehicles or new securement methods will never eliminate log spills.

There was not wide spread agreement among the drivers that crib style hauling is a solution. Drivers point to years of experience with crosswise loaded trucking and millions of miles with relatively few incidents. Many drivers felt that the reduction in payload capacity due to the extra steel in a crib vehicle was a significant financial penalty.

BACKGROUND

Timber and Pulp Market

The world's desire for wood and wood derived products, especially paper, is ever increasing. The big question is how the United States and especially the State of Michigan will compete as a world supplier. The U.S. is the largest wood products and fiber consuming nation in the world. In 2004, Americans used more wood products than any time in history. Total annual sales of paper and forest products exceed $230 billion.

One of the growing concerns in the U.S. wood industry is the availability of raw product. At least one Michigan producer (Louisiana-Pacific OSB mill in Sagola) underwent a plant shutdown for a couple weeks in November, 2004, due to a log shortage.

Since May, 2002, the U.S. has imposed an import duty on Canadian softwood. The United States currently has an average 20.2% countervailing and anti-dumping duty on softwood lumber coming into the U.S. from Canada. This tariff has been reduced from its initial level of 27.2%. But the issue of the legality of the tariff has been under review by the World Trade Organization (WTO) and to date every decision has gone against the U.S. In January, Canada asked the WTO to approve $200 million in sanctions against U.S. imports in an effort to demonstrate Canada's position on the dispute. If the tariff is absolved, then the flow of softwood from Canada *could* increase significantly. In 2003, the U.S. bought $4.6 billion in timber from Canada, approximately one third of the U.S.'s market demand.

A long term concern about the health of the U.S. wood industry comes from the third world countries. Economics and fewer regulations and restrictions are the primary driving factors. As the world's use of wood products steadily increases, the demand is being met abroad. No new mills have been built in the U.S. in the last ten years. The American Forest and Paper Association (AFPA) claims that 92 pulp and paper mills have closed and 47,000 jobs were lost in the U.S. timber industry in the last five years.

Wood fiber for the production of paper is much cheaper in developing countries. For example, a new paper mill being considered by International Paper in Brazil would have the capacity to produce 900,000 metric tons of pulp fiber per year. The decision to locate in South America was driven by economics: The fiber cost for a ton of copy paper is $29 versus $125 in the U.S.; and salaries average $5,000 – $6,000 per year versus an average of $65,000 in the U.S.

Although international companies have moved operations to developing countries where restrictions are few and labor is cheap, former U.S. Forest Chief Max Peterson believes the availability of imports from other countries is not sustainable for even the next ten years.

The U.S. timber industry blames its problems on competition from abroad and the number of restrictions and regulations for logging in the United States. Besides the rising costs of wages, equipment, insurance, and fuel; virtually all planned logging on federal land in recent years has been challenged thereby raising the costs of timber rights on private land. Whether the challenges are for endangered species like the spotted owl, concerns about erosion and increasing sediment in streams, the protection of old growth forests, or the roadless initiative, timber sales on federal lands has decreased significantly. The lack of timber sales has led to a decrease in the entire U.S. timber industry. The 192 million acres of U.S. National Forests are currently providing about 20% of the timber that they have in the past. At a forum celebrating the 100th anniversary of the U.S. Forest Service, Jack Ward Thomas, the Forest Service Chief from 1993 to 1997 commented, "It costs so much to do anything in a national forest that the only practical thing is to do nothing."

Recent changes in federal forest policy under the current administration are beneficial to the timber industry. After a couple years of enormously devastating wildfires, President Bush introduced the *Healthy Forest Initiative* in August, 2002. The *Healthy Forest Restoration Act* (HFRA – H.R. 1904) was passed on Dec. 3, 2003. This bill streamlined the procedures for logging in federal forests and encouraged the removal of "fuel" from fire prone areas. Originally financed at a level of $760 million dollars annually, $811 million was appropriated for 2005. President Bush has included more than $867 million in the 2006 fiscal year budget. However, the program is realizing the effects of years of anti-logging activities. As mills closed and unemployed loggers moved to other professions, the U.S. Forest Service is now finding that there are no buyers for the timber sales that they are holding under the HFRA. On December 22, 2004, President Bush issued sweeping new rules for managing national forests. The changes will replace a burdensome bureaucratic planning process with a more corporate management approach.

In 2004, Michigan joined the movement to certify its state forestlands as being managed by the "best sustainable practices." *Public Act 125* of 2004 was introduced in February, 2004, and approved by the Governor on May 28, 2004. The Michigan Department of Natural Resources expects to certify Michigan's 4 million acres of state forests in 2005. Major corporations like Home Depot and Time, Inc. are demanding that 80% of the fiber content be from sustainable forests by 2006. On July 22, 2004, the Governor signed *Public Act 249* of 2004 which requires state agencies to give preference to products that are derived from sustainably managed forests.

In early January, 2005, the largest land-protection deal in the State of Michigan was brokered in the Upper Peninsula. At stake were 271,000 acres (423 square miles) of forest land. The Forestland Group LLC sold 23,000 acres to the Nature Conservancy. The Conservancy will eventually transfer 23,000 acres to the State of Michigan. A conservation easement was granted for the remaining 248,000 acres. This easement allows public access for recreation and permits the harvesting of timber under internationally recognized sustainable forestry guidelines. The timber harvesting from this area was estimated at $200 million per year and supports 3,000 jobs in the region.

When MeadWestvaco was sold in the beginning of 2005, it was broken up into two companies; NewPage became the paper making business and all the land holdings went to Escanaba Timber, LLC. On September 30, 2005 Plum Creek Timberlands agreed to purchase the 650,000 acres for $345 million. In addition, International Paper has its 452,000 acres of Michigan timberland up for sale. These figures provide some indication of how big and critical the timber industry is to Michigan – and it is not going to go away.

BACKGROUND ON MICHIGAN TIMBER INDUSTRY

Both the US Department of Agriculture – Forest Service (USDA-FS) and the Michigan Department of Natural Resources (DNR) collect extensive data about Michigan's forests. Their reports detail the species, location and quantities of timber harvested; where it is being processed; and what it is being used for. Table XX shows the distribution of roundwood that was harvested in 1999 in Michigan. Pulpwood and saw logs accounted for 94.6 % of the volume of roundwood produced. The volume of saw logs and veneer logs, the main products harvested in the Upper Peninsula other than pulpwood, were approximately two thirds (2/3) the volume of pulpwood.

Industrial Roundwood Production
Michigan 1998

Ref. XX, Summarized from Table 3, page 22

	Cords	%
Pulpwood	2,661,538	58.3%
Saw Logs	1,657,557	36.3%
Fuelwood	117,240	2.3%
Veneer Logs	84,468	1.9%
Posts	22,582	0.5%
Cabin Logs	20,291	0.4%
Shaving	6,886	0.2%
Poles	6,747	0.1%
Misc	468	0.0%
TOTALS	4,577,778	100.0%

Note: Standard conversion factors applied in order for all quantities to be stated in cords

The timber is a regional commodity and Michigan both imports and exports to its neighbors. Table xx summarizes the flow of pulpwood in 2001 and 2002.

PRODUCTION, EXPORTS and IMPORTS of PULPWOOD

(in standard cords, unpeeled)

	2001	2002
Stayed in Michigan	**2,238,301**	**2,281,733**
Exported to Canada	**12,565**	**11,175**
Exported to Minnesota	**8,503**	**10,156**
Exported to Wisconsin	**186,814**	**148,337**
Imported from Wisconsin	**256,616**	**244,330**
Imported from Canada	**52,683**	**74,727**
TOTAL	**2,755,482**	**2,770,458**
Produced in Michigan	**2,446,183**	**2,451,401**
Processed in Michigan	**2,547,600**	**2,600,790**

The 2002 USDA-FS report indicated the largest producers that are consumers of raw timber products. (Note: some paper mills either purchase all their pulp fiber or use recycled fiber and do no onsite processing of logs into pulp fiber). Identified as Table 9 in their report, the following table is a condensed version that only includes the wood pulp mills within the study area and within 120 miles of the Michigan border (where Michigan timber could potentially flow).

WOOD PULP MILLS

Production = Average daily production in Tons per 24 hours

		Production
Wood Pulp Mills in Michigan		
Mead-Westvaco	Escanaba	1,227
International Paper	Quinnesec	1,224
Smurfit-Stone Container	Ontonagon	751
Packaging Corp. of America	Manistee	361
Louisana-Pacific	Alpena	250
Other Wood Pulp Mills within 120 miles of Michigan border		
Packaging Corp. of America	Tomahawk, WI	1,378
Stora Enso	Wisconsin Rapids, WI	1,200
Sappi	Cloquet, MN	1,153
Domtar	Nekoosa, WI	450
Stora Enso	Proctor, Mn	325
Stora Enso	Niagra, WI	250

Besides the paper mills, the other major producers that are consumers of Michigan's roundwood are the particle board and panel mills, including plywood and oriented strand board (OSB). The following table is a condensed version of Table 10 of the USDA-FS 2002 report.

Particle Board and Panel Mills in Michigan		
Production = Million square feet 3/4 inch basis		
Board and Panel Mills in Michigan		Production
Weyerhauser	Grayling	249
Georgia-Pacific	Gaylord	204
Louisana-Pacific	Sagola	205
Louisana-Pacific	Newberry	65
Other Particleboard Mills within 120 miles of Michigan border		
Louisana-Pacific	Hayward, WI	250

The preceding tables do not address sawmills and veneer mills. Major sawmills in Michigan include: Potlatch (formerly Louisiana Pacific) in KI Sawyer/Gwinn, Biewer Lumber in McBain, Northwest Hardwoods in Lewiston and Northern Hardwoods in South Range. Besse Forest Products Group operates a number of mills in Michigan and northern Wisconsin: Newberry, Escanaba and Baraga. Timber Products Co of Newberry is both a veneer mill and sawmill. These are the largest mills. There are many more medium and small mills that are too numerous to list. A facility like Ottawa Forest Products in Ironwood that consumes over 23,000 cords of hardwood per year and upwards of 40 truckloads of logs per week; may seem significant, only until it is compared to a large pulp mill that wants 2,000 – 3,000 cords per day.

Another source of information on the Michigan timber industry came from the Michigan Economic Development Corporation. The MEDC website was queried for the major employers in each county and any associated with the timber industry were highlighted. The following table was generated for largest timber industry employers in the study area.

Company Name	Location	Employ
MeadWestvaco Papers Group	Escanaba	1400
International Paper Co Inc	Norway	550
Kimberly-Clark Corp	Munising	400
Georgia-Pacific Corp	Gaylord	252
LP Alpena - ABT Co.	Alpena	250
Timber Products Co	Munising	250
Smurfit-Stone Container Corp	Ontonagon	250
Fletcher Paper	Alpena	240
Celotex	Baraga	220
Louisiana-Pacific Corp	Gwinn	200
LP Sagola	Sagola	165
Manistique Papers Inc	Manistique	155
Menominee Paper	Menominee	150
Great Lakes Tissue Co Inc	Cheboygan	150
Northern Hardwoods	South Range	150
Northern Michigan Veneers	Gladstone	145
Besse Forest Products Group	Gladstone	129
LP Newberry	Newberry	129
Connor Sports Flooring Corp	Amasa	120
Besse Forest Products Group	Gladstone	120
Bessemer Plywood Corp	Bessemer	120
Cedar River Lumber Co Inc	Powers	100
Custom Forest Products	Grayling	85
Superior Cedar Products Inc	Carney	80
Great Lakes Plywood	Kincheloe	75

The MEDC data was of marginal assistance (so therefore should not be included in this report?). Many companies on the list do not receive shipments of roundwood. Some of the companies have gone out of business in the last couple years.

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